

Appendix E–I
Original Construction Specifications
(SPC-269)

A-E CONSTRUCTION SPECIFICATION

SUBCONTRACT NO. SOO-588051

PROJECT FILE NO. 020978

OU 3-13 Group ■ Tank Farm Interim Action Phase ■ & 2

APPROVED FOR CONSTRUCTION

[Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho]

INEEL

Idaho National Engineering & Environmental Laboratory

BECHTEL BWXT IDAHO, LLC

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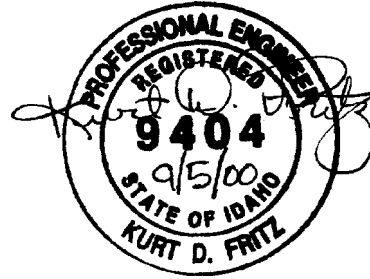
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OU 3-13, Group 1, Tank Farm Interim Action Phase 1 & 2

The following Sections of this Specification were prepared under the direction of the Professional Engineer as indicated by the seal and signature provided on this page. The Professional Engineer is registered in the State of Idaho to practice Civil Engineering.



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01051 Construction Surveying and Staking
01300 Submittals

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The following Sections of this Specification were prepared under the direction of the Professional Engineer as indicated by the seal and signature provided on this page. The Professional Engineer is registered in the State of Idaho to practice Electrical Engineering.



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12 FOR
13 OU 3-13, GROUP 1, TANK FARM INTERIM ACTION PHASE 1 & 2
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21 Prepared for:
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23 U.S. DEPARTMENT OF ENERGY
24 IDAHO OPERATIONS OFFICE
25

26 **Idaho Falls, Idaho**
27

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29 SPC No. 269
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41 Bechtel BWXT Idaho, LLC
42 Idaho Falls, Idaho 83415

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SECTION 01005--SUMMARY OF WORK

PART 1--GENERAL

SUMMARY:

The Subcontractor shall furnish plant, labor, material, equipment, supplies and perform work and operations necessary to construct the upgrades to the INTEC Storm Drainage System and Tank Farm complete, in accordance with the subcontract drawings and these specifications.

Section Includes: As shown on the contract drawings, work includes, but is not limited to:

Re-grading areas to improve drainage and coating with a polyurea spray-on coating and asphalt concrete paving.

Upgrading of the Storm Drainage System including: installing a lift station, new concrete ditches, installing or replacing corrugated metal pipe culverts, catch basins, and concrete head walls and end walls.

Construction of a lined evaporation pond.

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 OSHA General Industry Safety Standards
29 CFR 1926 OSHA Construction Industry Safety Standards

BECHTEL BWXT IDAHO, LLC (BBWI)

Construction Management Environmental, Health and Safety Requirements

Health and Safety Plan for Waste Area Group 3, Operable Unit 3-13, Group 1 Soils, Tank Farm Interim Health Action, RD/RA Phase 1 and 2

Emergency Preparedness Plan - Addendum 2 (ICPP [INTEC]), Latest Revision, Company Wide Manual 16A-2, PLN- 114-2

Unless otherwise specified, references in these specifications or on the subcontract drawings to other specifications, codes, standards or manuals which are part of these specifications, but

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not included herein, shall be the latest edition, including any amendments and revisions, in effect as of the date of this Specification.

SUBMITTALS:

See Section 01300, Submittals.

QUALITY ASSURANCE:

Quality Assurance Program requirements shall exist to assure that work performed is in conformance with the requirements established by the drawings and this specification. QA Program criteria applicable to this scope of work is addressed in SC-5 of the Special Conditions and these specifications.

Standard Products: The materials and equipment furnished by the Subcontractor shall be standard products of manufacturers regularly engaged in the production of the type of materials and equipment required and shall be of the manufacturer's latest standard designs. Where two or more units of the same type and class of material or equipment are required, the units shall be the product of the same manufacturer, and shall be identical insofar as possible. The component parts of a unit of equipment need not be the products of the manufacturer.

Repair of Damages:

General: Construction materials and equipment, flange facings, threads, machined or painted, and other exposed finished surfaces shall be protected from damage at all times during shipping, handling, construction and installation. Materials and equipment repaired or replaced by the Subcontractor shall be subject to acceptance by the Contractor.

SAFETY, HEALTH AND ENVIRONMENT:

All work shall be conducted in compliance with the Health and Safety plan for the WAG 3, OU 3-13, Group 1, Tank Farm Interim action RD/RA Phase 1 and 2.

In general work shall be in compliance with the applicable sections of 29 CFR 1910, 29 CFR 1926 and the BECHTEL BWXT Construction Management Environmental, Health, and Safety Requirements.

DELIVERY STORAGE AND HANDLING

All materials normally packaged shall be delivered to the site in the original, unopened packages with labels intact. Upon arrival, the Subcontractor shall inspect the materials or equipment for damage.

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1 Materials and equipment shall be stored and handled in accordance with the manufacturer's
2 instructions.

3
4 All hazardous materials shall be stored in such a manner to prevent spillage. Preventative
5 spill measures shall be required and implemented per the manufacturer's specifications.
6 Preventative spill measures and spill response activities shall be conducted in accordance
7 with the project Health and Safety Plan and the INEEL Emergency Preparedness Plan -
8 Addendum 2 (ICPP [INTEC]), Latest revision.

9 10 PART 2--PRODUCTS

11 12 MATERIALS:

13
14 New Materials and Equipment: Materials and equipment received by the Subcontractor in a
15 damaged condition shall be repaired or replaced by the Subcontractor as directed by the
16 Contractor. Materials and equipment damaged by the Subcontractor shall be repaired or
17 replaced by the Subcontractor.

18
19 Existing Materials, Equipment and Structures: Existing materials, equipment and structures,
20 including paint and protective coatings, involved under this Subcontract shall be thoroughly
21 inspected by the Subcontractor before starting any work. Any defects or damages, the repair
22 of which are not covered under these specifications or subcontract drawings, shall be reported
23 in writing to the Contractor by the Subcontractor. The Subcontractor shall place reinstalled
24 operating equipment in an operating condition that is at least as good as it was at the time the
25 Subcontractor started work.

26
27 Hazardous Chemicals and Substances: The Subcontractor shall comply with applicable
28 requirements of 29 CFR 1926.59, Hazard Communication Standard.

29 30 PART 3--CONSTRUCTION AND INSTALLATION

31
32 General: Materials and equipment shall be erected or installed only by qualified personnel
33 who are regularly engaged in the trades required to complete the work. The subcontract
34 drawings show the general arrangement and space allocation of the equipment specified. It
35 shall be the Subcontractor's responsibility to verify changes in conditions or rearrangements
36 necessary because of substitutions for specified materials or equipment. Where
37 rearrangements are necessary the Subcontractor shall, before construction or installation,
38 prepare and submit drawings of the proposed rearrangement for approval.

39
40 Coordination of Work: Where new work and existing facilities are shown on the drawings,
41 but are not located precisely by dimensions, the Subcontractor shall be responsible for proper
42 location and clearances and for correcting discrepancies and interferences in the work which
43 are a result of his operations. Work done by one trade that must be integrated with work of
44 other trades shall be laid out with due regard to the work done, or to be done, by other trades;

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1 particularly if the work done by one trade depends upon completion or proper installation of
2 work done by other trades. The Subcontractor shall cooperate in coordinating his work with
3 work being done by others if their work must be integrated with the Subcontractor's work.
4 The Subcontractor shall notify the Contractor at least one week prior to starting of the date on
5 which the Subcontractor proposes to proceed with the work.

6
7 Workmanship: Work shall be done in a skillful and workmanlike manner. The
8 Subcontractor shall do structural cutting, fitting, patching, repairing and associated work
9 necessary for installation of equipment, piping and electrical conduits, etc. No major cuts or
10 holes, not shown on the drawings, shall be made without prior approval of the Contractor.
11 After the equipment and/or piping is installed, exposed holes, cracks and other defects shall
12 be neatly patched and the patched areas shall match the adjoining materials and finish.

13
14 END OF SECTION 01005

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1 SECTION 01051--CONSTRUCTION SURVEYING AND STAKING

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Section Includes: Work includes, but is not limited to:

8
9 Establish vertical and horizontal control, slope staking, pipe layout and alignment, and set
10 grade-finishing stakes.

11
12 All coordinates are based on INTEC site-specific horizontal coordinates and NRTS vertical
13 datum. NRTS vertical is 0.35 ft. higher than INTEC vertical datum.

14
15 SUBMITTALS:

16
17 Submittals include but are not limited to the following:

18
19 Certification: Submit certification that the land surveyor is a registered professional.

20
21 Logbook: Copies of logbook entries shall be submitted upon completion.

22
23 See Section 01300, Submittals and Vendor Data Schedule for additional requirements.

24
25 QUALITY CONTROL:

26
27 Qualifications: Construction surveying and staking shall be accomplished under the direction
28 of a registered professional land surveyor.

29
30 PART 2--PRODUCTS

31
32 Stakes: Identification stakes and hubs shall be of sufficient length, width and depth to
33 provide a solid set in the ground and to provide space for marking above ground when
34 applicable. The top 2-in. of all slope, guard, reference, clearing, and structure stakes shall be
35 painted or marked with plastic flagging.

36
37 PART 3--EXECUTION

38
39 SURVEY REQUIREMENT:

40
41 Precision: Precision and accuracy requirements are contained in Table 1. The following
42 precisions shall be used:

43
44 Slope Staking Precision B

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1 Finish Staking, Subbase Course - Precision B

2 Finish Staking, Base Course - Precision A (Includes Tank Farm Grading)

3 Pipe Layout and Alignment - Precision B

4
5 Control: Existing control monuments can be located through the INEEL Construction
6 Management (526-3597).

7
8 Slope Stakes, Clearing Limits and Reference Stakes: Slope catch-points, clearing limits, and
9 slope reference stakes shall be established. The position of these stakes shall be determined
10 by methods that will produce on the ground the precisions shown in the Table 1.

11
12 Clearing limits shall be set within the tolerance shown in the Table 1. The clearing limit
13 shall be located on the ground and marked with lath, flagging, or other methods approved by
14 the Contractor's Representative.

15
16 The elevation and location of slope reference stakes shall be verified for accuracy by a
17 differential level run over the reference stakes between benchmarks.

18
19 Pipe Layout and Alignment: Pipeline layout and clearing limits shall be established. The
20 position of these stakes shall be determined methods that will produce, on the ground, equal
21 to Precision B as shown on Table 1.

22
23 Monuments of Property Boundaries or Surveys of Other Agencies: If property boundary or
24 survey monuments, or survey markers of other agencies, are found within or adjacent to the
25 construction limits, the Subcontractor shall immediately notify the Contractor's
26 Representative. These monuments shall not be disturbed.

27
28 Grade Finishing Stakes: Finishing stakes are required on the subbase, crushed base course,
29 tank farm grading, and grading areas required for polyurea spray-on coating. Stakes shall be
30 set on a 50-ft grid (25-ft. grid on Tank Farm) and at the shoulders. Subgrade finishing stakes
31 shall be red tops and base course finishing stakes shall be blue tops. Grade stakes are
32 required for tank farm grading and polyurea coating areas to verify a minimum slope of
33 0.50% towards the drainage ditches.

34
35 Finishing stakes shall be set when subbase is within 0.2 ft, or base course is within 0.1 ft of
36 final grade. The stakes shall be set to the nearest 0.01 ft of the measured grade line.

1

TABLE 1. CROSS SECTION AND SLOPE-STAKE PRECISION

Item	Precision		
	A	B	C
Cross section topography measurements shall be taken so that variations in ground from a straight line connecting the cross section points will not exceed:	0.5 ft	1.0 ft	2.0 ft
Horizontal and vertical accuracy for cross-sections. In feet or percentage of horizontal distance measured from transverse line, whichever is greater.	.05 ft or 0.2%	0.15 ft or 0.6%	0.2 ft or 1.0%
Horizontal and vertical accuracy for slope stake, slope stake references, and clearing limits. In feet or percentage of horizontal distance measured from centerline or reference stake, whichever is greater.			
a. Slope reference stakes and slope stakes.	0.1 ft or 0.4%	0.15 ft or 0.6%	0.2 ft or 1.0%
b. Clearing limits.	1.0 ft	1.0 ft	1.0 ft

2

3

FIELD QUALITY CONTROL:

4

5

Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

6

7

8

END OF SECTION 01051

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1 SECTION 01300--SUBMITTALS

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 This section specifies the administrative, technical and quality requirements for Vendor Data
8 submittals. Vendor Data requirements are identified in individual specification sections and
9 tabularized on a Vendor Data Schedule. In the event of conflicting requirements, the
10 submittal requirements prescribed in the individual specification section shall prevail.

11
12 The Subcontractor shall submit data, drawings, and other submittals specified. If the
13 Contractor determines the Subcontractor's submittal to be incomplete or unacceptable, the
14 Subcontractor shall make a complete and acceptable submittal to the Contractor by the
15 second submission of a submittal item.

16
17 The Subcontractor shall be responsible for advising the Contractor of any submittal that may
18 be delayed and which might, if further delayed, extend completion of the project.

19
20 Section Includes: Work includes, but is not limited to: The preparation, transmittal and
21 delivery of documents by the Subcontractor to the Contractor as required in the "Submittals"
22 subdivision of the specification section and as provided on the Vendor Data Schedule.

23
24 Related Sections: General Provisions, Special Conditions, Drawings and Vendor Data
25 Schedule and other sections of these specifications apply to this section.

26
27 REFERENCES:

28
29 The following documents, including others referenced therein, form part of this Section to the
30 extent designated herein.

31
32 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

33
34 ANSI Y 14.1 Drawing Sheet Size and Format

35
36 SUBMITTALS:

37
38 General Procedures:

39
40 Vendor data, whether prepared by the Subcontractor or Subcontractor's subtier or supplier,
41 shall be submitted as instruments of the Subcontractor. Therefore, prior to submittal, the
42 subcontractor shall ascertain that material and equipment covered by the submittal and the
43 contents of the submittal itself, meet all the requirements of the subcontract specifications,
44 drawings, or other contract documents.

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Each submittal shall contain identification for each separable and separate piece of material or equipment, and literature with respect to the information provided in the specification and on the Vendor Data Schedule. Submittals shall be numbered consecutively for each different submittal.

Vendor Data Schedule:

Vendor Data required by the specification sections to support construction and operation of the project is identified on a Vendor Data Schedule. The Vendor Data schedule is an attachment to the Specification. The Vendor Data Schedule provides a tabular listing by item number, drawing or specification reference, and description of the item or service. The type of submittal is identified by a vendor data code, which is preceded by the number of copies to be included with the submittal. Routine submittals will require 6 copies for Mandatory Approval and 4 copies for Information Only. The time required to submit the item is identified by a "When to Submit" code. **An** "Approval" code specifies whether the submittal is for Mandatory Approval or for Information Only. A column is included to indicate if receiving inspection is required.

Or Equal Material or Equipment Submittals:

All "or equal" materials, equipment or systems shall be identified and submitted for approval as required by the General Provisions.

An "or equal" submittal shall contain as a minimum all operating and physical parameters necessary to show that the material or equipment is equivalent to the specified material or equipment. All parameters shall be specifically identified by the submitter in the proposal. Exceptions or differences between the specified item and the "or equal" item shall also be identified.

If an "or equal" material, equipment or system is approved, the Subcontractor shall be responsible backup material necessary to include the material, equipment or system in the technical documents. In most cases this includes "red lining" a set of design drawings, and specifications to provide an "Approved for Construction" set of specifications **and** design drawings which incorporate the changes caused by the "or equal" item. These "red line" drawings shall be submitted prior to use of the "or equal" item. Any calculations or other backup material necessary to show that changes are adequate shall be included with the "red line" drawings and specifications.

Construction Vendor Data Transmittal and Disposition Form:

All vendor data shall be submitted to the Contractor using the Construction Vendor Data Transmittal and Disposition Form. The form provides the Subcontractor a convenient method to submit vendor data and provides the Contractor a means of dispositioning the submittal. The Subcontractor shall list the Vendor Data Schedule item number, drawing or

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1 specification number, submittal status (e.g. Information Only, Re-submittal, or Or-equal
2 submittal by placing the quantity enclosed in the space) and the item description. The
3 description should include the heat or lot number for items requiring Certified Mill Test
4 Reports.

5
6 Disposition by the Contractor

7
8 The Contractor's comments and required action by the Subcontractor will be indicated by a
9 disposition code on the submittal. The disposition codes will be classed as follows:

10
11 (A) "Work May Proceed." Submittals so noted will
12 generally be classed as data that appears to be satisfactory without corrections.

13
14 (B) "Work May Proceed Subject to
15 Incorporation of Comments." This category will cover data, which, with the
16 correction of comments noted or marked on the submittal, appear to be
17 satisfactory and require no further review by the Contractor prior to construction.
18 Revised drawings shall be provided upon request.

19
20 (C) "Work May NOT Proceed. Revise and
21 Resubmit." Submittals so dispositioned will require a corrected resubmittal for
22 one of the following reasons.

- 23
24 1) Submittal requires corrections, per comments, prior to final review.
25 2) Submittal data incomplete and requires more detailed information prior to
26 final review.
27 3) Submitted data does not meet specification requirements.

28
29 (D) "Received for Information Only." Submittal so dispositioned will generally be
30 classified as Information Only for as-specified material and equipment.

31
32 Mandatory Approval code vendor data will be reviewed by the Contractor and receive an A,
33 B, or C disposition. Information Only submittals will receive a D disposition. A, B, and C
34 coded dispositioned submittals will be returned to the Subcontractor. D dispositioned
35 submittals will not be returned to the Subcontractor. The Contractor may provide internal
36 review of Information Only submittals. In the event that comments are generated on an
37 Information Only submittal, the submittal may be re-dispositioned B or C code and returned
38 to the Subcontractor for appropriate action. Acknowledgment of receipt of dispositioned
39 vendor data by the subcontractor will not be required.

40
41 The Contractor will return dispositioned submittals with reasonable promptness.
42 Subcontractor shall note that a prompt review is dependent on timely and complete
43 submittals in strict accordance with these instructions.

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PART 2--PRODUCTS (SUBMITTAL REQUIREMENTS)

EQUIPMENT DATA:

Where specifically required by other sections, equipment data shall be provided. As applicable and except as otherwise specified, equipment data shall include the manufacturer's name and address, the model number, and specific information on performance, operating curves and data, ratings, capacities, characteristic efficiencies, catalog data, equipment dimensions, evidence of compliance with safety and performance standards, and other data required to fully describe the equipment. Data shall be submitted in sets covering complete systems or functioning units. The data shall also be identified with the tag number of the equipment or device for which the data applies.

INSPECTION AND TEST PROCEDURES:

Where specifically required by other sections, inspection and test procedures shall be provided. Inspection and test procedures shall include, as applicable: description of item or items involved, inspection or testing to be performed, a listing of testing agency and technical personnel to be used, description of equipment and facilities to be used, test prerequisites, test methods, test evaluation and acceptance criteria, safety precautions, sign-off requirements, methods for control and calibration of measuring and test equipment, proposed test record form, references to applicable portions of the subcontract documents, and detailed procedures, methods, and criteria for evaluation and acceptance. Test procedures shall be prepared in accordance with Article SC-5 "QUALITY ASSURANCE" of the Special Conditions.

INSPECTION AND TEST REPORTS:

Where specifically required by other sections, inspection and test reports shall be provided within 10 working days of such inspection or test. Inspection and test reports shall include, as applicable: identification of material or item inspected, inspection data, functional test data, date(s) and place(s) of inspection/tests, names of agencies and technicians involved, references to procedures and methods used, references to applicable portions of the subcontract documents, names of persons evaluating test results, identification of work failing to meet inspection/test acceptance criteria, and detailed description of corrective action taken.

INSTALLATION, APPLICATION, AND ERECTION INSTRUCTIONS:

Installation, application, and erection instructions shall be provided where specifically required by other sections. Installation, application, and erection instructions shall be clear, concise, and detailed, and shall utilize drawings and pictures to the extent necessary. The instructions shall include procedures for delivery acceptance, unpacking, inspection,

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1 repacking, storage, handling, preparation of supporting work, assembly, and incorporation of
2 the material/equipment into the work. The instructions shall include sequences, precautions,
3 and tolerances.

4
5 In general, the Contractor's Representative will inspect the work to the criteria and
6 instructions prescribed in the manufacturer's installation, application and erection
7 instructions. The Subcontractor shall not deviate from the written instructions without prior
8 written approval and direction from the manufacturer; such approval and direction shall be
9 submitted to the Contractor as an attachment to the manufacturer's installation, application
10 and erection instructions.

11 12 MATERIAL AND EQUIPMENT LISTS:

13
14 Where specifically required by other subdivisions, material and equipment lists shall be
15 provided. Material and equipment lists shall be complete for the work specified under the
16 subdivision and shall include all materials, products, equipment, and fixtures, including
17 consumables. Lists shall include manufacturer's name and address, trade or brand name,
18 local supplier's name and address, unit quantities and catalog numbers required to fully
19 describe the item.

20 21 OPERATION AND MAINTENANCE (O&M) MANUALS:

22
23 Where specifically required by other sections, operation and maintenance manuals shall be
24 provided.

25
26 Contents: O&M manuals for manufacturer's standard items shall, unless otherwise specified,
27 be the standard publication issued for the product by the manufacturer.

28 29 PRODUCT DATA:

30
31 Where specifically required by other sections, product data shall be provided. Product data
32 shall include descriptive material, such as catalog data, diagrams, color charts, and other data
33 published by the manufacturer, as well as evidence of compliance with safety and
34 performance standards. To demonstrate conformance to the specified requirements; catalog
35 numbers alone will not be acceptable. The data shall include the name and address of the
36 nearest service and maintenance organization that regularly stocks repair parts.

37
38 Product data submittals shall reference the applicable subdivision and drawings, and be
39 complete for each item or unit of work.

40 41 SHOP DRAWINGS:

42
43 Where specifically required by other sections, shop drawings shall be provided. Each shop
44 drawing submittal shall be complete and shall be accompanied by technical and performance

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1 data as necessary to fully illustrate the information in the shop drawings, or cross referenced
2 to such data contained in previous submittals. Unless otherwise specified, submittals shall
3 consist of black-line printed copies. Hard copies and an electronic copy shall be submitted
4 where required by other specification sections. Electronic copies of **CAD** generated drawings
5 shall be provided in a form which will transfer to the Contractor's software using IGES or a
6 custom software provided by the Subcontractor. Sepia type prints are not acceptable. One
7 set of copies will be returned to the Subcontractor marked to show the required corrections or
8 approval.

9
10 All equipment or other devices shall be identified on the shop drawings by the tag number
11 indicated on the design drawings. The Subcontractor shall identify all equipment and devices
12 with tags or labels in accordance with the requirements specified in the respective
13 subdivision.

14
15 The following additional submittals shall be required as indicated on the Vendor Data
16 Schedule:

17
18 Redline Drawings: Copies of the shop drawings shall be updated to include all changes
19 or modifications made during construction and to reflect the actual conditions of
20 construction. Each drawing shall be marked "As-Built" and be signed by the
21 Subcontractor representative and shall be suitable for XEROX copying or microfilming.

22
23 Title Block and Identification: On each shop drawing, a 1-1/2x 2-1/2 in. space shall be
24 provided for the Contractor's review status stamp. Each shop drawing shall include a title
25 block showing:

26
27 Project name and location.

28
29 Name and address of Subcontractor or manufacturer as applicable.

30
31 Date, scale of drawings, unique drawing identification number, and referenced design
32 drawing number.

33
34 Subcontractor's review and approval stamp or signatures.

35
36 Revision record including signatures and dates.

37
38 Preparation and Size: Details and information shall be clearly drawn, dimensioned (including
39 tolerances), noted, cross referenced and shall be of such quality as to ensure legible B (11 x
40 17 in.) size photocopy reproductions from microfilm (by others). Drafting and drawing
41 standards shall be consistent with the practices established by ANSI or other acceptable
42 standards and as specified herein:

43
44 Where applicable, views shall be oriented so that plant north faces to the left or up.

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Use of abbreviations shall be avoided where space permits spelling in full; if used, abbreviations shall be described in a legend on the drawing.

Types: Shop drawing shall be of the specific types specified in the respective subdivisions. If a specific type is not specified, drawing shall be the type most commonly required for the specific class of work subject to the Contractor's approval. The most commonly required types of shop drawings and drawing content (as applicable) are described hereinafter.

Layout Drawings: Shall be consolidated for all trades in the subcontract, and show to scale pertinent structural and fenestration features and other items, such as cabinets, required for installation and which could affect the available space. Mechanical and electrical equipment and accessories shall be shown to scale in plan, elevation and/or section, in their installed positions. Duct work, plumbing, and piping shall also be indicated. Submittals describing the various mechanical and electrical equipment items, which are to be installed in areas represented by layout drawings, shall be assembled and submitted concurrently with and accompanied by the room layout drawings.

Wiring Diagrams: Shall identify all terminals, terminal blocks, and wires with wire numbers and colors. All wires within enclosures and all wiring connections to externally located equipment and devices shall be shown. For simple installations, wiring diagrams and control diagrams may be combined onto a common drawing.

SPARE PARTS LISTS:

Where specifically required by other sections, spare parts lists shall be provided. Spare parts lists shall include all spare parts and the current list price of each spare part. The spare parts lists shall also identify those spare parts, which each manufacturer recommends for maintenance at the site. Each manufacturer or vendor shall indicate the name, address, and telephone number of its spare parts source closest to the INEEL.

The Subcontractor shall cross-reference all spare parts lists to the equipment tag numbers designated in the specifications or on the drawings. If O&M manuals are specified for equipment, spare parts lists shall be submitted as part of the O&M manual.

CALCULATIONS:

Where specifically required by other sections, calculations shall be provided. Engineering calculations and analyses shall be fully checked by a qualified individual other than the originator, and shall be signed and dated as checked. All final submittals of calculations shall be bound and shall include the title and purpose of the calculation, a table of contents or index, complete list of references, design basis and complete list of assumption (if any), methodology, and sufficient information to allow independent verification of the calculation.

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Calculations which are performed by computer or with computer assistance shall include a description of the hardware and software used, a description of the model employed if applicable, verification documentation for the computer program, and a copy of the computer input and output. All revisions to submitted calculations, as a result of comments by the Contractor or design changes by the Subcontractor, however minor, shall be resubmitted.

SPECIAL PACKAGING, HANDLING, OR STORAGE PROCEDURES:

Where specifically required by other sections, special packaging, handling, rigging, shipping, storage, or preservation procedures shall be provided. These procedures shall contain the following minimum requirements as applicable:

Measures taken to prevent damage during transit.

Detailed description of container design.

Overall dimensions and approximate weight of container and contents.

Recommended method for off-loading.

List of required special off-loading devices.

Special instruction for proper packaging and preventative maintenance during storage at the site.

Special instructions for marking.

Safety code labels, if applicable.

PART 3--EXECUTION (NOT APPLICABLE)

END OF SECTION 01300

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1 SECTION 02062--DEMOLITION AND REPAIRS

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Section Includes: Work includes, but is not limited to:

8
9 Demolition as shown on the drawings

10
11 Saw cutting and removal of asphalt paving

12
13 Salvage of identified items and materials

14
15 Removal of existing CMP culverts, concrete headwalls, and catch basins

16
17 Removal of resulting rubbish and debris

18
19 SUBMITTALS:

20
21 No submittals required.

22
23 PROJECT/SITE CONDITIONS.

24
25 Condition of Structures or Facilities: Conditions existing at the time of inspection for bidding
26 purposes will be maintained insofar as practicable. Actual conditions may vary slightly due
27 to operations, which may occur prior to start of demolition work.

28
29 Protection: Ensure safe passage of persons in the vicinity of the demolition area. Conduct
30 operations to prevent injury to adjacent buildings, structures, other facilities and persons.
31 Provide and erect any necessary temporary enclosures, barricades, walkways, shoring,
32 bracing, etc., to ensure that safe conditions will exist.

33
34 Dust Control: The amount of dust resulting from demolition shall be controlled to prevent the
35 spread of dust to occupied portions of the construction site and to avoid creation of a
36 nuisance in the surrounding area. Use of water will not be permitted when it will result in, or
37 create, hazardous or objectionable conditions such as ice, flooding and pollution.

38
39 Burning: The use of burning at the project site for the disposal of refuse and debris will not
40 be permitted.

41
42 Use of Explosives: Use of explosives will not be permitted.

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1 PART 2--PRODUCTS

2
3 MATERIALS:

4
5 Disposition of Removed Equipment and Materials: The Government will retain title to all
6 equipment and materials removed by the work. Items which are to be reused under this
7 Subcontract shall be removed and stored as indicated below. Materials designated as scrap
8 shall be promptly disposed of as directed by the Special Conditions. Surplus material shall
9 be disposed of as directed in the Special Conditions (SC-16).

10
11 PART 3--EXECUTION

12
13 GENERAL:

14
15 All demolition and repair work shall be done in a neat and orderly manner without any
16 damage to existing facilities not directly involved under this Subcontract. The Subcontractor
17 shall be responsible for all damage to existing buildings or facilities caused by his operations
18 under this Subcontract.

19
20 POLLUTION CONTROLS: Use temporary enclosures and other suitable methods to limit
21 dust, spread of contamination, or spread of hazardous materials beyond the work area.

22
23 EXISTING STRUCTURES:

24
25 General: Existing structures shall be removed as indicated on the drawings.

26
27 Miscellaneous: All areas disturbed or demolished shall be patched and/or painted to match
28 existing adjacent areas.

29
30 CLEAN UP:

31
32 Debris and rubbish shall be removed from the demolition areas. Debris shall be removed and
33 transported in a manner that prevents spillage on streets or adjacent areas. Hauling and
34 disposal shall comply with the Special Conditions (SC-16).

35
36 FIELD QUALITY CONTROL:

37
38 Surveillance will be performed by Contractor's Representative to verify compliance of the
39 work to the drawings and specifications.

40
41 END OF SECTION 02062

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SECTION 02200--EARTHWORK

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to:

Clearing and grubbing as required.

Excavating all materials encountered, of every description, for completion of the Subcontract as shown on the drawings and as specified herein. Work includes trenching, excavating for concrete ditches, lift station, culverts, evaporation basin, headwalls, manholes, fence posts, and guard posts.

Backfilling of all excavations for piping, concrete ditches, catch basins, lift stations, etc.

Surface water and erosion control measures.

Installing a locator ribbon above utilities installed under this-Subcontract.

Compacting all backfill as specified herein.

Finish grading and grading for surface drainage.

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein.

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS
(AASHTO)

	Standard Specifications for Transportation Materials and Methods of Sampling and Testing
AASHTO M145	Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO T11	Standard Method of Test for Materials Finer Than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing
AASHTO T27	Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
AASHTO T99	Standard Method of Test for the Moisture-Density Relations of Soils Using a 5.5-lb (2.6-kg) Rammer and a 12 in. (305 mm) Drop

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AASHTO T238 Standard Method of Test for Density of Soil and Soil-Aggregate in
Place by Nuclear Methods (Shallow Depth)

CODE OF FEDERAL REGULATIONS

29 CFR 1926 OSHA General Industry Safety Standards, Subpart P

IDAHO TRANSPORTATION DEPARTMENT (ITD)

SSHC Standard Specification for Highway Construction, 1999

SUBMITTALS:

Submittals include, but are not limited to the following:

No Vendor Data required for this section unless an "or-equal" item is proposed.

See Section 01300, Submittals and the Vendor Data Schedule for additional submittal requirements.

PART 2--PRODUCTS

MATERIALS:

Satisfactory Soil Materials: Satisfactory soil materials are defined as those complying with AASHTO M145, soil classification Groups A-1, A-2-4, A-2-5, and A-3.

Unsatisfactory Soil Materials: Unsatisfactory soil materials are those defined in AASHTO M145 soil classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7; also peat and other highly organic soils.

Backfill and Fill Material: Excavated material shall be used as fill material. "Satisfactory" soil materials free of clay, rock, gravel larger than 3 in. in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter. If required, select pit run gravel is available at the CFA and TRA gravel pits. Gravel pit material and use of the gravel pits shall be at no cost to the Subcontractor. Upon completion of operations involving fill material removal, the Subcontractor shall grade and reshape the disturbed areas. Sloped surfaces shall meet the requirements of OSHA 29 CFR 1926.

Base Course Material: Naturally or artificially graded mixture of 3/4 in. maximum size crushed gravel, crushed stone, natural and crushed sand. Material shall meet the requirements of ITD subsection 703.04.

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Buried Pipe Locator Ribbon: Ribbon shall be 3 in. wide and shall be red for all electrical conduits, electrical cables, and telephone cables. Yellow ribbon shall be used for all buried pipelines. Orange ribbon shall be used on cathodic protection. Ribbon shall be tape manufactured by Reef Industries or Allen Markline or equal and shall have metal foil which is completely encased in plastic so as to be unaffected by cathodic protection systems and can be easily detected by metal detectors. The ribbon shall be printed with the manufacturer's standard wording, "CAUTION ELECTRIC LINE BURIED BELOW," for all electrical conduits, phone lines, etc., "CAUTION BURIED PIPELINE BELOW," for all buried pipelines, and "CAUTION CATHODIC PROTECTION," for all buried cathodic protection systems.

PART 3--EXECUTION

EXCAVATION:

Clearing and Grubbing: All areas to be occupied by the evaporation pond, berms and other similar structures plus 10 ft outside these areas and 1 ft outside sidewalk areas and pipe trenches, shall be stripped and cleared of all brush, weeds, rubbish and organic matter. All vegetable matter, roots, brush and debris encountered during the stripping operations shall be removed from the cleared areas to a depth of at least 8-in. below the subgrade. Resulting depressions shall be completely backfilled and compacted in accordance with the applicable part of these specifications except in those cleared areas where further excavation is required. Stripped material shall be stockpiled as specified hereinafter and on the drawings.

Grading Surface Materials: The area to be occupied by the polyurea spray-on coating (see Drawing C-25), including the tank farm area, shall be re-graded and shaped to provide a minimum of 0.50% slope towards the concrete lined ditches. Low spots shall be filled with excess excavated material and compacted. The resulting graded and shaped area shall be compacted to 90% optimum density. In the tank farm area, hand work may be required around existing structures. See attached Management Control Procedure MCP-P7.5 and drawing 097726 for tank farm area load restriction requirements.

Earth Excavation: Earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, soil material of any classification, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

Hand Excavation: Any excavation within 5 feet horizontally or 2 feet vertically of marked underground energized or pressurized cables or piping not present in a concrete ductbank shall be done by hand.

Rock Excavation: No rock excavation is required.

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1 Unauthorized Excavation: Unauthorized excavation consists of removal of materials beyond
2 indicated elevations or dimensions without specific direction by the Contractor.

3 Unauthorized excavation, as well as remedial work directed by the Contractor, shall be at the
4 Subcontractor's expense.
5

6 Structural: Excavations for such structures as footings, headwalls, endwalls and slabs shall
7 be made to the depths shown on the drawings and of sufficient width to allow adequate room
8 for setting and removing forms, installing accessories and inspection. Where concrete
9 foundations or slabs are to be constructed on material other than rock, care shall be taken to
10 prevent disturbing the bottom of the excavation. Excavation to final grade shall not be made
11 until just before concrete forms are to be placed therein. Concrete foundations shall be
12 placed only on undisturbed soil or rock.
13

14 Trenches: Trenches shall be of sufficient width to provide adequate room for workmen to
15 perform any necessary service to the materials or items being installed therein and to permit
16 proper compaction of the backfill.
17

18 Grade: The bottom of pipe trenches shall be graded to allow for a minimum of 4 in. of
19 compacted sand bedding beneath the pipe. Bell holes shall be shaped so that pipe will
20 be uniformly supported for its entire length on the compacted sand backfill. Hubs or
21 flanges shall be unsupported until the pipeline has been tested, coated, and wrapped, as
22 required.
23

24 Stockpiling and Disposal: Excavated material that is suitable and required for backfilling, or
25 grading, shall be piled in an orderly manner a sufficient distance from the edge of the
26 excavation, but in no case closer than 2 ft, and so located that it will not interfere with normal
27 vehicular or pedestrian traffic. Excavated materials to be used for backfill shall be kept free
28 from vegetation and other objectionable materials. Excavated materials not required or not
29 approved for backfilling, grading or topsoil, shall be stockpiled. Topsoil cleared for the
30 construction of the evaporation pond shall be stockpiled on-site for use in the outer berm
31 construction to promote re-vegetation. Topsoil stockpiles shall be covered with 8-mil
32 Visqueen, or similar approved material, to prevent erosion. Unused excavated earth and
33 combustible materials shall be hauled to areas designated by the Contractor and disposed of
34 in a manner specified in the Special Conditions.
35

36 Unstable Soils: If wet or otherwise unsatisfactory soil is encountered in an excavation, at or
37 below the excavation line, it shall be brought to the attention of the Contractor and removed
38 as directed in accordance with Article 38, "Differing Site Conditions", of the General
39 Provisions. The bottom of the excavation shall then be brought to the required grade with
40 concrete or compacted backfill as specified hereinafter. Excavation of unstable soil resulting
41 from the Subcontractor's neglect to keep the excavated opening dry, and other over depth
42 excavation not required to satisfactorily complete the work, shall be brought up to the
43 required grade with concrete or compacted backfill as specified hereinafter at the
44 Subcontractor's expense.

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Shoring and Bracing: The sides of all excavations shall be sloped or securely shored and braced in accordance with **OSHA** 29 CFR 1926, Subpart P.

Control of Water: All excavations shall be kept free of standing water. The Subcontractor shall furnish, install and operate the equipment required to keep excavations free from water at all times. Water shall be disposed of in a manner that will not cause injury to property.

BACKFILL OR FILL:

General: The excavations shall be cleared of all trash and debris prior to backfilling or filling. All backfill or fill material shall be free from trash, organic matter and frozen particles. Backfilling or filling shall be done only when approved by the Contractor. In excavations that are shored, shoring and formwork shall be removed or raised as backfill or fill is placed.

Under Headwalls, Slabs or Pavement: Backfill or fill materials under concrete slabs, floors, sidewalks, and concrete including fill for manholes shall be compacted fill material as specified in the "Materials" section, except that the last 2 in. of such fill shall be compacted base course material. Backfill or fill materials under asphalt pavement shall be compacted fill material as specified in the "Materials" section, except for paving in a roadway or driving surface. Asphalt paving through roadway and driveway sections shall have the last 4 in. of such fill be compacted base course material.

Pipelines: Bedding for piping and buried tanks shall be compacted sand or other approved granular material unless otherwise shown on the drawings. Bedding material shall extend from a minimum of 4 in. beneath the pipe to a minimum cover of 4 in. The remainder of the trench or excavation shall be backfilled as specified hereinafter.

Overdepth Pipeline Excavation: Where pipe trenches are excavated to an overdepth due to the presence of rock, unstable soil or other unsuitable material, the overdepth shall be backfilled to required grade with compacted sand or other approved granular material.

Placement: Concentrated dumping of backfill or fill material into excavations will not be permitted. No water shall be used for placing, settling or compacting backfill or fill except to obtain optimum moisture content. All material must be placed in uniform layers not to exceed 8 in. loose measurement and brought up simultaneously and evenly on both sides of foundation walls and around underground or covered structures and equipment such as culverts, manholes, storage tanks and pipe. Backfill or fill around piping, and at least 4 in. over, shall be hand placed and compacted prior to pressure testing. Pipe joints shall be left exposed until leak testing has been completed. Care shall be taken when backfilling, filling, or compacting around any buried items or dampproofed walls to prevent injury to the item being covered and to prevent piercing or rupturing the insulation, coating or dampproofing membrane. Loose backfill or fill may be placed as specified hereinafter.

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1 Compaction: Unless otherwise indicated on the drawings or specifications, compact all
2 backfill and fill material under slabs, roads, sidewalks, and other surfaced areas, around
3 foundation walls, culverts, underground tanks and other similar structures and to at least **4** in.
4 compacted depth above all piping in trenches. Unless otherwise indicated, all "compacted"
5 backfill or fill shall be compacted to at least 95% of maximum density at optimum moisture
6 content as determined by AASHTO T99. Each 8-in., maximum, loose measurement lift shall
7 be compacted before the next lift is placed thereon. Compacted backfill or fill density and
8 moisture content may be measured by the Contractor at any location and depth. Sections of
9 backfill or fill failing to meet the minimum compaction requirements shall be corrected prior
10 to placement of subsequent lifts. No heavy equipment shall be allowed within 5 ft of a
11 structure or the foundation of any structure. No heavy equipment shall be allowed over
12 piping until a minimum of 24 in. of backfill has been compacted over the piping.

13
14 Locator Ribbon: The locator ribbon shall be placed in a zone 6 to 12 in. from the ground
15 surface directly over the utility during the backfill and compaction operation.

16
17 FIELD QUALITY CONTROL:

18
19 Surveillance will be performed by the Contractor's Representative to verify compliance of the
20 work to the drawings and specifications.

21
22 END OF SECTION 02200

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1 SECTION 02430--CULVERTS AND TRENCH DRAINS

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Work shall include furnishing and installing new culverts, trench drains and appurtenances in
8 accordance with these specifications and the subcontract drawings.

9
10 Section Includes: Work includes, but is not limited to:

11
12 Furnish and install CMP culverts, trench drains, and appurtenances.

13
14 REFERENCES:

15
16 The following documents, including others referenced therein, form a part of this Section to
17 the extent designated herein:

18
19 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

20
21 ASTM A 798 Standard Practice for Installing Factory-Made Corrugated Steel Pipe
22 for Sewers and Other Applications

23
24 SUBMITTALS:

25
26 Product Data: Submit product data for trench drains, which includes installation instructions.

27
28 Submit pipe certification for culverts.

29
30 See Section 01300, Submittals and Vendor Data Schedule for additional submittal
31 requirements.

32
33 QUALITY CONTROL:

34
35 Regulatory Reaquirements (Codes and Standards): Comply with the following codes and
36 standards, unless otherwise specified herein:

37
38 ASTM A 798 Standard Practice for Installing Factory-Made Corrugated Steel Pipe
39 for Sewers and Other Applications

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1 PART 2--PRODUCTS

2
3 MATERIALS:

4
5 Culverts: The culverts shall be 16-gage minimum or 14-gage where specified galvanized or
6 aluminized corrugated steel pipe with standard o-ring or gasketed connection bands at all
7 joints.

8
9 Trench Drains: The surface drainage system shall be ACO Drain FG200 channel slope by
10 ACO Polymer Products, Inc. or approved equal. The system shall be 8" nominal width and
11 manufactured with a continuous 1.0-% slope.

12
13 The channel, frame and grating combination shall withstand an AASTO H-20 loading.
14 Grating shall be cast or ductile iron and the grate shall be locked securely to the frame.

15
16 Channel sections shall be joined together with a lap joint not less than 2" and be designed to
17 minimize disturbance to flow. All joints shall be sealed during installation with a material
18 suitable for storm-drain use.

19
20 The pre-sloped system shall be manufactured in modular lengths of not less than 6 feet. The
21 use of neutral sections (no slope) may be used, at a minimum, to extend the system to the
22 required length.

23
24 PART 3--EXECUTION

25
26 INSTALLATION:

27
28 Location: Install culverts to lines and grades shown on the drawings.

29
30 Earthwork: Excavation, backfilling and grading shall be performed in accordance with
31 Section 02200 Earthwork. Bedding for corrugated metal pipe shall be in accordance with
32 ASTM A 798 standard practice for installing factory-made corrugated steel pipe for sewers
33 and other applications. A minimum of 8" cover shall be provided over culverts.

34
35 The subgrade for trench drain installation shall be uniform as per the plan drawings. Abrupt
36 changes in elevation grade of the prepared surface is to be avoided. The surface shall be
37 compacted in accordance with Division 2, Section 2 "Earthwork" and sloped to comply with
38 the manufacturer's recommendation.

39
40 Installation of the fiberglass trench system shall be in strict accordance with the
41 manufacturer's recommendation.

42
43 Laying Corrugated Metal Pipe: The outside laps of circumferential joints shall point
44 upstream and longitudinal laps shall be at the sides. The lugs on the coupling bands of metal

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1 pipe shall be placed to one side of the top of the center line of the pipe so that they will not
2 extend above the top of the pipe.

3
4 The space between the pipe and the connecting band shall be kept free from dirt so that
5 corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a
6 soft-head mallet to take up slack and insure a tight joint.

7
8 Pipe and Trench Drain Testing: Hydrostatic pressure testing will not be required.

9
10 FIELD QUALITY CONTROL:

11
12 Surveillance will be performed by Contractor's Representative to verify compliance of the
13 work to the drawings and specifications.

14
15 END OF SECTION 02430

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SECTION 02444--CHAIN LINK FENCING

PART 1--GENERAL,

SUMMARY:

The Subcontractor shall provide all labor, material, and equipment to construct the fence in accordance with the drawings and these specifications.

Section Includes: Work includes, but is not limited to:

Furnish and install the fencing as shown on the drawings, including gates and all hardware, complete and ready to use.

Related Sections:

Section 03300 Cast In Place Concrete

REFERENCES:

The following documents, including others referenced herein, form part of this Section to the extent designated herein.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 90	Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles With Zinc or Zinc-Alloy Coatings
ASTM A 153	Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A 392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM F 669	Standard Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence
ASTM F 1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

SUBMITTALS:

Product Data: Submit product data including installation instructions and verification that the product complies with these specifications.

See Section 01300, Submittals and Vendor Data Schedule for additional submittal requirements.

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1 PART 2--PRODUCTS

2
3 MATERIALS:

4
5 Posts, Rails, and Braces: All posts, rails, braces and appurtenances shall be hot-dipped zinc
6 coated per ASTM A 123, or A 153, whichever is applicable. Line posts shall be 2.38 in.
7 O.D. x 3.65 lb/ft. Comer, gate and pull posts shall be 4.5 in. O.D. x 10.79 lb/ft. Bracing shall
8 be 1.66 in. O.D. x 2.27 lb/ft unless otherwise indicated on the drawings. Gate posts and
9 comer posts shall be filled with concrete prior to capping.

10
11 Chain Link Fabric: Metal fence fabric shall be No. 9 gage wire woven into a 2-in. mesh.
12 Fabric finish shall be hot-dipped zinc galvanized per ASTM A 392. Finish shall provide not
13 less than 1.0 oz. of zinc per sq. ft of fabric when tested in accordance with ASTM A 90.

14
15 Hardware and Accessories: All hardware and accessories shall be galvanized to comply with
16 ASTM A 153, Table I. Double leaf gates shall have fork type latch with center drop rod with
17 a positive locking gravity device, arranged to engage the gate stop as shown on the drawings.

18
19 Wire Ties: Use 9 gage minimum aluminum wires for tying chain link fabric to rails, posts
20 and braces.

21
22 Tension Wire: Tension wire shall be 7 gage, coated coil spring wire with metal and finish
23 matching that of new fabric. Locate at bottom of chain link fabric on new fence.

24
25 Swing Gate: The swing gate shall be a double leaf swinging gate with capacity to open to
26 180 degrees of the fence both ways. Gate posts and frame shall be of galvanized pipe as
27 shown on the drawings.

28
29 Grounding Material: Grounding material shall conform to the requirements given on the
30 drawings.

31
32 Concrete:

33
34 Concrete for fence posts shall be Class 30 (3000 psi).

35
36 The manufacture and delivery of concrete shall conform to *Division 3* Section, 03301
37 "Concrete Work". No test cylinders shall be required for fencing work.

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1 PART 3--EXECUTION

2
3 INSTALLATION/ERECTION:

4
5 General: Place concrete around posts in a continuous pour, tamp for consolidation. Verify
6 that each post is plumb and at the proper elevation and alignment. Set keepers, stops, sleeves
7 and any other accessories into concrete as required.

8
9 Rock drilling will not be required for the placement of the posts. If required, it shall be
10 brought to the attention of the Contractor's Representative.

11
12 Top Rails: Run rail continuously through post caps. Provide expansion couplings as
13 recommended by fencing manufacturer.

14
15 Center Rails: Install in one piece between posts and flush with post on fabric side, using
16 special offset fittings where necessary.

17
18 Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper
19 tension.

20
21 Steel Fabric: Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on sides
22 of posts exterior to the enclosed area and anchor to framework so that fabric remains in
23 tension after pulling force is released.

24
25 Stretcher Bars: Thread through or clamp to fabric every 4 in., and secure to posts with metal
26 bands spaced 16 in. o.c.

27
28 Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping
29 pipe and fabric firmly with ends twisted at least 2 full turns. Bend wire to minimize hazard
30 to persons or clothing.

31
32 Tension Wire: Install tension wire on new fence before stretching fabric and tie to each post
33 with not less than 9 gage galvanized wire. Fasten fabric to tension wire using 11 gage
34 galvanized steel hog rings spaced 24 in. o.c. Install tension wire with chain link fabric only.
35 Do not use with plastic fence fabric.

36
37 Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric
38 side.

39
40 Gates: Install gates plumb, level, and secure for full opening without interference. Install
41 ground-set items in concrete for anchorage, as recommended by fence manufacturer. Adjust
42 hardware for smooth operation and lubricate where necessary. Hinges shall be installed to
43 prevent removal by lifting off.

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1 FIELD QUALITY CONTROL:

2

3 Surveillance will be performed by the Contractor's Representative to verify compliance of the
4 work to the drawings and specifications.

5

6 END OF SECTION 02444

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SECTION 02486--REVEGETATION

PART 1--GENERAL

SUMMARY:

This work shall consist of seedbed preparation, sowing of grasses, and application of fertilizer.

Section Includes: Work includes, but is not limited to:

Prepare seed bed, furnish and sow seed, and furnish and apply fertilizer.

Related Work:

Section 02200 – Earthwork

REFERENCES:

None.

SUBMITTALS:

No Vendor Data required for this section unless an “or-equal” item is proposed.

PART 2--PRODUCTS

The Subcontractor shall furnish the materials and equipment necessary to revegetate disturbed sites.

MATERIALS:

Grass Mix: The following grass mix shall be used in disturbed area surrounding the evaporation pond, outer berm slopes, and "V" shaped ditch for the spillway.

Grass Mix

<u>SPECIES</u>		<u>RATE OF APPLICATION</u> <u>(POUNDS PER ACRE PURE LIVE SEED)</u>
P-27 Siberian Wheatgrass		4
“Ephraim” Crested Wheatgrass		5
“Sodar” Streambank Wheatgrass		9
Total		18

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1 Seed Mix Sources:

2
3 Approved dealers for the seed mixes are:

4
5 Granite Seeds (801) 768-4422
6 Grimm Growers (208) 785-0830
7 Wind River Seed (307) 568-3361
8 Maple Leaf (800) 287-3162
9

10 Fertilizer: Fertilizer shall be 19-48-0(NPK) ammonium or diammonium phosphate. Each
11 component of the fertilizer may vary two percent.
12

13 Mulch: Mulch shall be processed grass straw.
14

15 EQUIPMENT:

16
17 Seedbed Preparation: Replace stockpiled material over disturbed areas to be used as a
18 seedbed. Refer to Section 02200 – Earthwork. Use disks, harrows, roller harrow-packers
19 (culti-packers), tooth type harrows, shovels, or other similar equipment as required to prepare
20 the seedbed.
21

22 Seeding and Fertilizing: Use equipment such as drills with double disc agitator, ground
23 driller hand seeders, or culti-packers with seed boxes to apply seeding and fertilizer. Do not
24 use dry broadcast seeders or hydroseeders.
25

26 PART 3--EXECUTION

27
28 Season of Work: Seeding shall be done between September 1 and December 15.
29

30 Seedbed Preparation: The stockpiled soil from excavation shall be uniformly distributed over
31 the trenches and the side slopes of the berms. Soil shall be tilled a minimum depth of 3-
32 inches. The seedbed shall be firm below the seeding depth and well pulverized and loose on
33 top. It shall be free of clods and weeds. Seedbed preparation shall not be performed when
34 soil conditions are not suitable for tilling: too dry, too wet, frozen, etc. Tillage shall produce
35 cross-slope furrows on slopes.
36

37 On areas subject to severe erosion, the extent of seedbed preparation shall not exceed that
38 which can be seeded in one day.
39

40 Fertilizing: Fertilizing shall closely follow seedbed preparation. Fertilizer shall not be mixed
41 with seed. Fertilizer may be drilled or broadcast. Fertilizer shall be applied at a rate of 50
42 pounds per acre.
43

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1 Seeding: Seeding shall closely follow fertilizing. If the seedbed has been disturbed, then the
2 Subcontractor shall prepare the seedbed again. Seeds shall be thoroughly mixed prior to
3 application. Seeds shall be uniformly applied at the previously specified rate. Seeds shall be
4 buried 0.25 to 0.75 inches. Seeding shall not be performed when weather conditions are
5 unfavorable: high wind, heavy rain, etc.

6
7 Drill seeding shall be performed in areas with slopes of 3:1 or flatter and where there is not
8 excessive rock and gravel. Other areas shall be seeded by broadcasting.

9
10 Drilling shall maintain cross-slope furrows on slopes.

11
12 Mulching: Mulch shall be spread uniformly at a rate of 1 ton per acre. Mulch shall be
13 anchored into the soil to a depth of at least 2-in., and with no more than one pass of the
14 equipment. Mulching shall not be performed when wind interferes with mulch placement.

15
16 Protection: Traffic over seeded area shall be prohibited.

17
18 Clearing and Grubbing: Vegetation from the clearing and grubbing shall be placed over the
19 seeded areas. Care shall be taken to avoid disturbing the seedbeds.

20
21 FIELD QUALITY CONTROL:

22
23 Surveillance will be performed by the Contractor's Representative to verify compliance of
24 the work to the drawings and specifications.

25
26 END OF SECTION 02486

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SECTION 02514--ASPHALT CONCRETE PATCHING

PART 1--GENERAL

SUMMARY:

Provide all work, operations and material required to construct asphalt concrete patching in accordance with the project drawings and these specifications.

Section Includes: Work includes, but is not limited to:

Patching areas disturbed by excavation/trenching through paved areas.

Paving areas as designated on the design drawings.

Furnish and apply tack coat where applicable.

Haul, place and compact asphalt concrete mix.

REFERENCES:

The following documents, including others referenced therein, form a part of this Section to the extent designated herein.

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO Standard Specifications for Transportation Materials and Methods of
Sampling and Testing
AASHTO M226 Viscosity Graded Asphalt Cement

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 946 Standard Specification for Penetration Graded Asphalt Cement for use
in Pavement Construction

IDAHO TRANSPORTATION DEPARTMENT (ITD)

ITD SSHC Standard Specifications for Highway Construction, 1999
ITD Field Test Manual, Part I, Sampling and Test Methods

SUBMITTALS:

Submittals include, but are not limited to the following:

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The Subcontractor shall submit the mix design data sheets.

QUALITY CONTROL:

Regulatory Requirements: (Codes and Standards): Comply with provisions of the following codes and standards, unless otherwise specified herein. Idaho State Specifications are available for inspection at offices of the Division of Highways, State of Idaho, the Department of Energy (DOE), Idaho Operations Office Headquarters, and Facilities Design at the Engineering Research Office Building (EROB).

AASHTO M226

ASTM D 946

ITD SSHC

PART 2--PRODUCTS

Asphalt: The asphalt cement shall be Viscosity Grade AC-5. Products shall meet applicable requirements of Section 702 of the SSHC, AASHTO M226/Table 1, and ASTM D 946.

Tack Coat: The tack coat shall be an emulsified asphalt, SS-1 or SS-1h, meeting the applicable requirements of Section 702 (SSHC).

Crushed Gravel for Aggregate: The master gradation for aggregate for the asphalt concrete shall be as follows unless modified in writing:

Sieve	Percent Passing
3/4	100
1/2	95-100
3	75-90
No. 4	50-75
No. 8	35-60
No. 30	15-35
No. 50	10-25
No. 200	4-8

PART 3--EXECUTION

QUALITY CONTROL TESTING:

Contractor Supplied Testing: The following tests may be performed by the Contractor's Representative.

Idaho T- 125 (Nuclear Densimeter) for asphalt concrete in-place density.

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Idaho T-87 for surface smoothness of finished pavement.

Composition of Mixture: The asphalt concrete shall be composed of a mixture of aggregate, filler if required, and asphalt. The mix design shall be tested by an independent test laboratory based on the aggregate gradation before mentioned, and shall meet one of the following criteria:

Marshall Method:

Stability:	500-lb minimum
Flow:	8 to 20
Air Voids:	3% to 5%

HVEEM Method:

Stability:	37 minimum (See 405.04 of SSHC)
Swell:	Less than 0.030 in.
Air Voids:	3% to 5%

Mix design test results shall be submitted for approval, and the approved design mix shall be in effect unless modified in writing by the Contractor.

The aggregate and asphalt shall be mixed in accordance with SSHC Section 405.11.

BASE CONSTRUCTION:

The placement and compaction of the base leveling course material shall be in accordance with Division 2 Section, "Earthwork".

SURFACE PREPARATION:

The Subcontractor shall saw cut the existing asphalt pavement back 6 to 10 inches from the edge of excavation in a neat, vertical straight line. Any fractured, heaved, undermined or otherwise damaged asphalt beyond the 6 to 10 inch offset cut shall be "squared out" as directed by the Contractor's Representative and repaved.

TACK COAT:

Immediately prior to replacing any asphalt surfacing, the Subcontractor shall paint all edges of the old mat with an asphalt tack coat. Distribute at rate of 0.10 gal per sq. yd of surface.

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1
2 PLACING AND FINISHING ASPHALT CONCRETE:
3

4 General: The asphalt plant mix shall then be spread uniformly and without segregation
5 across the entire width of the area where the surfacing has been removed and where the patch
6 is required. It shall be spread to such a depth that when compacted to its maximum density,
7 the patched surface will match the existing surface. The asphalt concrete shall be compacted
8 to 95% standard density.
9

10 Surface Smoothness: The Subcontractor shall "rake" all edges to ensure the availability of a
11 sufficient number of fines to seal the joints.
12

13 FIELD QUALITY CONTROL:
14

15 Surveillance will be performed by Contractor's Representative to verify compliance of the
16 work to the drawings and specifications.
17

18 END OF SECTION 02514

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SECTION 02598--POND LINER

PART 1--GENERAL

SUMMARY:

The Subcontractor shall supply all labor and materials required to provide a non-woven geotextile, high density polyethylene (HDPE) drainage net (geonet) and HDPE geomembrane liners for the evaporation pond complete and in accordance with the drawings and specifications.

Section Includes: Work includes, but is not limited to:

Furnish and install pond liners as shown on the drawings and this specification.

Furnish and install pond drainage net as shown on the drawings and this specification.

Furnish and install non-woven geotextile as shown on the drawings and this specification.

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

SUBMITTALS:

Submittals include but are not limited to the following:

Quality Control Plan: Submit a quality control plan for fabrication and installation for approval. Specific details shall be shown where sealing around pipe penetrations and other structures.

Installation and Shop Drawings: Submit drawings and product data showing proposed panel layout including field seams, details, balast and safety ladders.

Certification: Submit certification that the material supplied meets the Materials requirements.

As-Built Drawings: Submit as-built redline drawings showing actual geomembrane panel placement and seams including typical anchor trench details.

Test Reports: Submit test procedures and reports for liner fabrication and seam inspection.

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Qualifications: Submit certification of personnel performing fabrication and installation of the fabric. Submit the names of the projects and references, which document the subcontractor's qualifications.

Warranty: Submit pond liner warranty.

See Section 01300, Submittals and Vendor Data Schedule for additional submittal requirements.

QUALITY CONTROL:

The installation Subcontractor shall be approved by the manufacturer of the liner materials. A representative of the company furnishing the liners shall be present during the entire installation procedure and shall provide technical assistance for the installation of the lining.

The Subcontractor shall be an established firm regularly engaged in manufacturing and installing liner systems for the past 5 years installing a minimum of 5,000,000 square feet of HDPE lining.

The Subcontractor shall provide documentation of an approved Subcontractor Quality Control Plan for the fabrication and installation of the flexible membrane liners.

Documentation shall be submitted with the liner certifying compliance with the Materials section of this specification.

DELIVERY, STORAGE AND HANDLING:

Delivery, storage and handling of the materials shall conform to the manufacturer's recommendations and shall be done in such a manner as to prevent damage to any part of the work.

PROJECT/SITE CONDITIONS:

The purpose of this work is to install a double lined containment system with leak detection for a new earth pond to contain stormwater runoff for a duration of 20 years.

The maximum depth of the liquid in this open-air pond will be approximately 15-ft. Liquid levels will vary due to evaporation and variations in flow. There will be times when the pond will be empty.

The temperature of the contained liquid will vary with the ambient temperature.

Refer to subcontract drawings for dimensions of the pond.

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The pond is located at the Idaho National Engineering and Environmental Laboratory in southeast Idaho. The mean temperature at this location is 42° F, with a summer high of 100° F, and a winter low of -40° F.

The highest recorded winds are 80 mph.

WARRANTY:

Manufacturer shall provide a written 10-year prorated warranty on the HDPE liners. The installation shall be warranted against defects in workmanship for a period of 2 years from the date of geomembrane completion.

PART 2--PRODUCTS

MATERIALS:

Prior to the liner installation, a non-woven geotextile shall be installed to protect the liner from the subgrade. The non-woven geotextile shall meet the minimum physical requirements indicated in Table 1 below.

Typical Properties	Test Method	Requirements
Grab Tensile Strength	ASTM D4632	205 lbs
Grab Elongation	ASTM D4632	50%
Puncture Strength	ASTM D4833	110 lbs
Mullen Burst	ASTM D3786	350 psi
Trapezoidal Tear	ASTM D4533	85 lbs
Apparent Opening Size	ASTM D4751	80 US Std Sieve
Permittivity	ASTM D4491	1.50 ⁻¹
Permeability	ASTM D4491	0.38m/sec
Water Flow Rate	ASTM D4491	110pm/ft ²
W Resistance (% retained after 500 hours)	ASTM D4355	70%

The HDPE liner membrane shall be designed and manufactured specifically for the purpose of containment of liquids in hydraulic structures. It shall be manufactured from new, first-quality HDPE resin and shall meet the minimum physical requirements indicated in the Physical Properties table (Table 2). The resin used to produce the geomembrane shall be formulated to be resistant to chemical and ultraviolet degradation.

Boots for pipe penetrations shall be prefabricated and designed to fit site-specific conditions for the intended slope and size of the pipe. Boots shall be of the same material as the geomembrane.

Table-2 Mini

Typical Properties	Test Method	Reauirements
Thickness-minimum average value	ASTM D751/D1593/D5199	60 mils
Thickness-individual minimum value		54 mils
Sheet Density (Min.)	ASTM D792/D1505	0.94 g/cc
Carbon Black Content (Min.)	ASTM D1603/D42 18	2 %
Tensile Properties (Typical) 1. Tensile Strength at Break 2. Tensile Strength at Yield 3. Elongation at Break 4. Elongation at Yield	ASTM D 638, NSF 54 Modified, Type IV Die, 2"/min Gage length = 2.5 in. Gage length = 1.3 in.	228 lb/in 132 lb/in 560 % 13 %
Tear Resistance, (Min. Value)	ASTM D1204 Die C	45 lbs
Seam Properties 1. Shear Strength (Min.) 2. Peel Strength (hot wedge fusion) – Min Value 3. Peel Strength (fillet extrusion) – Min Value	ASTM D4437, NSF mod ASTM D4437, NSF mod ASTM D4437, NSF mod	120 lb/in 90 lb/in 78 lb/in
Dimensional Stability, Percent Change Each Direction (Max.)	ASTM D1204, NSF Modified	+1.0 %
Puncture Resistance (Min. Value)	FTMS 101 Method 2065	78 lbs

Certified test results from the manufacturer showing that the HDPE meets or exceeds the material requirements shall be provided.

The sheeting shall be a flexible, durable, watertight product free of pinholes, blisters, holes and contaminants.

The HDPE drainage net shall be designed and manufactured specifically for the purpose of containment of liquids in hydraulic structures. It shall be manufactured from new, first-quality HDPE resin and shall meet the minimum physical requirements indicated in the Physical Properties table (Table 3).

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Typical Properties	Test Method	Min. Requirements
Tensile Strength	ASTM D5034/5035	45 lb/in
Transmissivity	ASTM D4716	$1 \times 10^{-3} \text{ m}^2/\text{sec}$
Thickness	ASTM D5199	200 mils
Density	ASTM D1505	0.94 g/cc
Carbon Black Content	ASTM D1603/D4218	2 %

Possible HDPE suppliers include GSE Lining Technologies, Inc., National Seal Co., and Serrot Corp.

PART 3--EXECUTION:

PREPARATION:

The geotextile and lining installation shall not begin until after a proper base has been prepared to accept the HDPE membrane. The base material shall be smooth and free from sharp objects that could puncture the lining. All vegetation, roots and grass must be removed. Any cracks or voids shall be filled.

The subgrade surface shall be made uniform as per the plan drawings. Abrupt changes in elevation grade of the prepared surface is to be avoided. The surface shall be compacted in accordance with Division 2, Section "Earthwork" and shaped to comply with the manufacturer's recommendations.

Acceptance of the subgrade surface by the Contractor and liner manufacturer's representative is required before proceeding with the installation of the liner. This acceptance will be limited to the amount of area that may be lined during a particular work shift. Direction and control of any subsequent repairs to the subgrade, including the subgrade surface, shall remain the responsibility of the Subcontractor. Subgrade acceptance by the Contractor does not constitute acceptance of construction variables, such as moisture content and compaction.

FACTORY QUALITY CONTROL:

Receiving Inspection

When HDPE roll goods are received from the manufacturer, the roll numbers and production lot number given on the packing list shall be verified.

Rolls shall be inspected to assure rolls have not been visibly damaged during transit.

Random testing shall be done by the Contractor to assure that the HDPE lining delivered meets project specifications for gauge, roll width, taper, positive crown, dimensional

1 stability, and minimum tensile properties. Test results shall be compared with the minimum
2 requirements established by NSF Standard 54.

3 4 Fabrication and Inspection

5
6 In order to minimize field-seaming requirements during installation, individual rolls of HDPE
7 shall be factory fabricated into large panels, to the extent possible. Factory panels will be
8 fabricated with solvent or thermal welding. A 12-inch cross-sectional panel retainer shall be
9 removed from each production run. This will be used for factory and field seam testing.

10
11 After the panel retains are cut, samples shall be tested for bonded seam strength (stress
12 strength) and peel adhesion. All seam testing shall be performed as required by NSF
13 Standard 54. Bonded seam strength tests for HDPE shall be done in accordance with ASTM
14 D6392 (as modified in NSF Standard 54). Peel adhesion test for HDPE shall be conducted in
15 accordance with ASTM D6392 (as modified in NSF Standard 54). All seam strength test
16 reports shall be furnished to the Contractor.

17 18 INSTALLATION

19
20 The non-woven geotextile, HDPE drainage net and HDPE geomembrane liners shall be
21 applied as shown in the drawings and as recommended by the manufacturer's specifications
22 and.

23 24 Drainage Net Installation:

25
26 The drainage net shall be installed by overlapping each panel approximately 4 inches. The
27 overlap shall be tied in place with plastic ties or approved equal at a rate of one tie every 5
28 feet. Ties shall be a contrasting color to the drainage net (e.g., white).

29 30 Panel Placement and Seaming:

31
32 The HDPE geomembrane liners shall be placed over the prepared surface and geotextile and
33 drainage net as shown in the drawings, in such a manner as to assure minimum handling.
34 The Subcontractor shall be responsible for surveying to control the location and placement of
35 the liners. Control coordinates are shown on the plans.

36
37 The liner shall be installed in relaxed condition, free of stress or tension upon completion of
38 the installation. Stretching the liner to fit is not permissible. Sufficient material (slack) shall
39 be provided, to allow for geomembrane expansion and contraction.

40
41 Lap joints shall be used to seal factory fabricated panels of HDPE together in the field.
42 Contact surfaces of the two sheets shall be wiped clean to remove all dirt, dust, moisture or
43 other foreign materials. Field seams can be made by extrusion or hot wedge welding under
44 the direction of the manufacturer.

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The liner shall be attached to the concrete splash apron with an adhesive and a stainless steel strap. Details shall be submitted on the shop drawings. Special attention shall be given to all field seams especially around the concrete structures and pipe penetrations to assure water tightness.

The adhesive shall comply with WSD-6015 by Watersave Company Inc. or approved equal. Stainless steel shall comply with ASTM 276 and ASTM A240.

Trial Welds: Trial welds shall be performed on geomembrane samples to verify welding equipment operations and performance of seaming methods and conditions. A minimum of two trial welds shall be performed per day or shift per welding apparatus, one made prior to the start of the work and one completed mid shift. Welds shall be made under the same surface and environmental conditions as the production welds (ie., in contact with geomembrane subsurface and similar ambient temperatures).

Trial Weld Testing: Samples shall be at least five feet long and one foot wide with the seam centered lengthwise. Five, one-inch wide test strips shall be cut from the trial weld. Each of the specimens shall be tested in the field for peel. A trial weld specimen shall pass when the results are achieved for peel tests as shown in these specifications. Remaining samples shall be retained for future testing. For double-wedge welding, both welds shall be individually tested and both shall be required to pass in peel.

Field Welding:

Seams can be made by extrusion or hot wedge welding. The primary method of welding shall be double wedge welding with extrusion welding used for repairs and detailing. The machine shall be set to the predetermined temperature and speed. A trial seam shall then be run and tested to verify these settings before welding on the membrane is started. The machine settings shall be adjusted accordingly. Extrusion and single wedge seams shall have a nominal six-inch overlap and a nominal two-inch bond. Dual wedge seams shall have a nominal six-inch overlap and two half-inch wide bonds separated by a one-inch air channel.

Extrudate shall be made from the same resin as the geomembrane, and shall be free of contamination by moisture or foreign matter. Additives shall be thoroughly dispersed in the extrudate. The subcontractor shall test the resin for the following properties:

Properties	Test Method	Test Frequency
Density	ASTM D792/D1505	1 per Resin Batch
Melt Flow Index	ASTM D 1238	1 per Resin Batch
Carbon Black Content	ASTM D1603/D42 18	1 per Resin Batch

Results from testing shall be submitted to the Contractor.

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Seams shall be welded only when ambient temperatures are between 32" F and 110° F as measured six inches above the geomembrane surface. However, temperature is of less concern to good seam quality than is moisture. For cold weather seaming, it is advisable to preheat the sheets with a radiant heater, or a hot air blower, or to use a tent in order to determine appropriate seaming conditions. No welding shall take place when it is snowing, sleeting, or raining.

Visual Inspection:

After welding, a close visual inspection of the seams shall be made. This is to be done as soon as possible after the weld has been completed. The inspection is to include weld alignment. For extrusion welding, the weld thickness and profile is to be inspected.

Defective areas shall be marked and repaired. This inspection/repair process is to be carried out in a systematic manner as soon as possible to ensure that no defective area goes unrepaired.

NON-DESTRUCTIVE SEAM STRENGTH TESTING

The Subcontractor shall perform non-destructive seam testing of all field seams over their full length using vacuum box testing, air pressure testing (for fusion wedge welded seams only), or spark testing.

Vacuum Box Testing:

The equipment shall include two vacuum box assemblies consisting of the following: a rigid housing, a transparent viewing window, a soft neoprene gasket, attached to the bottom, a port hole or valve assembly, a vacuum gauge, a vacuum device equipped with pressure control, a rubber pressure/vacuum hose with fittings and connections, a soapy solution and an applicator.

Testing shall conform to the following procedure: brush a soapy solution on the geomembrane. Place vacuum box over the wetted seam area. Ensure that a leak-tight seal is created. Apply a vacuum of approximately 5 psi. Examine the geomembrane through the viewing window for the presence of soap bubbles for not less than ten seconds. All areas where soap bubbles appear shall be marked and repaired as described in this section.

Air Pressure Testing (for fusion wedge welded seams):

The equipment shall consist of the following: an air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining pressures over 35 psi and mounted on a cushion to protect the geomembrane, a rubber hose with fittings and connections, a sharp hollow needle, or other approved pressure feed device, and a pressure gauge.

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Testing shall conform to the following procedure: seal both ends of the seam to be tested. Insert needle or other approved pressure-feed device into the channel created by the double-wedge weld. Energize the air pump to a minimum of 25 psi but no greater than 30 psi, close the valve and sustain the pressure for at least five minutes. If pressure loss exceeds 3 psi or does not stabilize, locate faulty area and repair as described in this section. Puncture opposite end of the seam to release air. If blockage is present, locate and test seam on both sides of blockage. Remove needle or other approved pressure-feed device and seal penetration holes by extrusion welding as necessary.

Spark Testing:

The spark test method consists of introducing 24 gauge copper wire placed at the edge or just under the top sheet overlap of the two sheets, prior to the welding with the extruder. After welding, a spark detector, operating at 20,000 volts, is run along the weld. If any pinholes are present, a circuit will be completed through the copper wire and the spark detector. This will sound an alarm in the detector alerting the operator the presence of a defective area. The spark test is typically used for extrusion welded seams where there is no hazard anticipated from a spark and where there is no chance of creating a vacuum seal.

The spark detector should not be used in the presence of water or excessive moisture. There is no immediate danger to human or animal life if a circuit is made through the spark detector.

Destructive Seam Strength Testing:

Destructive testing shall not be permitted.

Joints to Structures:

The HDPE membrane shall be sealed to all concrete structures and other openings through the lining with an approved adhesive and in accordance with details shown on the plans and approved shop drawings.

Factory and field fabricated pipe boots shall be used to seal all pipes penetrating the liner. All joints shall be tightly bonded.

Defects and Repairs:

The geomembrane shall be examined for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The geomembrane surface shall be clean at the time of examination. Each suspect location shall be repaired and non-destructively tested.

Damaged geomembrane shall be removed and replaced with the same membrane type if damage cannot be satisfactorily repaired.

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Any portion of the geomembrane exhibiting a flaw or failing a non-destructive test shall be repaired. Procedures available include:

- Patching used to repair large holes (over 3/8" diameter) and tears (over 2" long), and contamination by foreign matter.
- Abrading and re-welding: used to repair small seam sections (less than 12" long).
- Spot welding: used to repair small tears (less than 2" long), pinholes, or other minor localized flaws.
- Capping used to repair large lengths of failed seams.
- Removing the unsatisfactory material or seam and replacing with new material.

Patches or caps shall extend at least 6" beyond the edge of the defect, and all corners of material to be patched shall be rounded to a radius of at least 3".

Repairs shall be non-destructively tested using methods specified in this section.

Preparation of Concrete Surfaces: Concrete surfaces which are to be lined shall have all rough edges and projections removed in the area of the lining. All cracks in the concrete shall be cleaned and filled with a sand-cement mortar or approved system prior to application. Extruded expansion joint material and joint sealers shall be cut off flush. The entire surface to be lined shall be cleaned of all foreign materials and swept thoroughly.

Balast: Place load balast on the geomembrane, which will not damage liner to prevent wind uplift. Number, size and spacing shall be under the strict recommendation of the liner manufacturer and shall be detailed on the shop drawings. Balast shall consist of "sand tubes" or polypropylene bags filled with grout. Paper bags are not permitted.

FIELD QUALITY CONTROL

Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

END OF SECTION 02598

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1 SECTION 03301--CAST IN PLACE CONCRETE

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Section Includes: Work includes, but is not limited to:

8
9 Concrete work for concrete ditches, headwalls, trench drains, fence posts, slabs, and
10 other miscellaneous concrete.

11
12 REFERENCES:

13
14 The following documents, including others referenced therein, form part of this Section to the
15 extent designated herein. The ASTM specifications referred to herein are a part of ACI 301.

16
17 AMERICAN CONCRETE INSTITUTE (ACI)

18
19 ACI 301 Specifications for Structural Concrete for Buildings
20 ACI 318 Building Code Requirements for Reinforced Concrete

21
22 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

23
24 ASTM A 185 Standard Specification for Steel Welded Wire Fabric, Plain, for
25 Concrete Reinforcement
26 ASTM A 615 Standard Specification for Deformed and Plain Billet-Steel Bar for
27 Concrete Reinforcement
28 ASTM C 33 Standard Specification for Concrete Aggregates
29 ASTM C 150 Standard Specification for Portland Cement
30 ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete
31 ASTM C 309 Standard Specification for Liquid Membrane-Forming Compounds for
32 Curing Concrete
33 ASTM C 494 Standard Specification for Chemical Admixtures for Concrete
34 ASTM C 618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural
35 Pozzolan for Use as a Mineral Admixture in Concrete

36
37 SUBMITTALS:

38
39 Submittals include, but are not limited to the following:

40
41 Mix Design: Submit mix design for each grade of concrete used.

42
43 See Section 01300, Submittals and the Vendor Data Schedule for additional submittal
44 requirements.

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QUALITY CONTROL:

Comply with provisions of ACI 301 unless otherwise specified herein.

PART 2—PRODUCTS

FORM MATERIALS:

Forms for Concrete: Furnish in largest practicable sizes to minimize number of joints.
Comply with applicable provisions of ACI 301.

Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

REINFORCING MATERIALS

Reinforcing Bars: ASTM A 615, Grade 60, deformed, as indicated on the drawings.

Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing in place.

CONCRETE MATERIALS:

Portland Cement: Cement shall conform to ASTM C 150, Type I-II. The cement shall contain no more than 0.60% by weight of alkalis calculated as ($\text{Na}_2\text{O} + 0.658 \text{K}_2\text{O}$).

Pozzolans: Pozzolans (fly ash) shall conform to ASTM C 618 Class F, except that the loss on ignition (LOI) shall be less than 2%.

Aggregate: Fine and coarse aggregate shall conform to ASTM C 33.

Mixing Water: Potable having no pronounced taste or odor, and containing no deleterious materials.

Air-Entraining Agents (AEA): ASTM C 260.

Water-Reducing Admixtures: If water-reducing admixtures are used they shall conform to ASTM C 494, Type A, and contain no more than 1% chloride ions.

Calcium Chloride: Calcium chloride is not permitted.

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RELATED MATERIALS:

Curing Compound: Curing compound or curing-hardener-sealer compound shall comply with ASTM C 309, Type I, Class A.

Red Coloring for Electrical Duct Encasement: Commercial grade red iron oxide, 3 lb per sack of cement.

Nonshrink Grout: Provide one of the following or approved equal:

- “Masterflow 713”; Master Builders
- “Sorrogout”; Sonnebour Building Products
- “Fire Star Grout” U. S. Grout Co.

Joint Sealing Compound: Provide a polyurethane joint sealant material.

PROPORTIONING AND DESIGN OF MIXES:

Mix Design: Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318.

Design mixes to provide normal weight concrete with the following specified 28-day compressive strengths, minimum, as indicated on drawings and schedules:

- Class 30: 3000 psi (for fence posts, footings, thrust blocks, pipe and conduit encasement)
- Class 45: 4500 psi (structural concrete for ditches, headwalls, and endwalls)
- Class 50: 5000 psi (precast concrete)

See ACI 301, Chapter 17 for acceptance criteria.

The concrete mix shall contain a pozzolan (fly ash) [unless otherwise approved by the Contractor’s Representative].

Concrete in hard-to-place locations may utilize a high-range water reducer. No other water-reducer shall be used with a high-range water-reducer.

Durability: Concrete which will be subject to freezing and thawing, weathering, **and** deicer chemicals shall be air-entrained, and shall have a minimum 28-day compressive strength of 4,500 psi and a maximum water-cement ratio of 0.45. Add air-entraining agent (AEA) at the manufacturer’s prescribed rate to result in concrete at point of placement having air content complying with ACI 301.

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1
2 MIXING AND DELIVERY:

3
4 The manufacture and delivery of all concrete shall conform to ACI 301. Hand-mixed
5 concrete is prohibited.

6
7 Concrete which is rejected for failure to meet any of the above requirements will be evaluated
8 by the Contractor and may be removed and replaced at the expense of the Subcontractor.

9
10 SOURCE QUALITY CONTROL:

11
12 The Subcontractor shall provide the necessary testing and monitoring to qualify proposed
13 materials and establish mix designs.

14
15 PART 3--EXECUTION

16
17 FORMS:

18
19 Comply with ACI 301.

20
21 PLACING REINFORCEMENT:

22
23 Comply with ACI 301.

24
25 Unless otherwise shown on the drawings, splicing of reinforcement shall be in accordance
26 with ACI 318, Chapters 7 and 12. Unless otherwise indicated on the drawings, all splices
27 shall be Class B tension splices for regular bars.

28
29 JOINTS:

30
31 Construction Joints: Locate and install construction joints, when not shown on drawings, so
32 as not to impair strength and appearance of the structure, and as acceptable to the Contractor's
33 Representative.

34
35 Joint Sealing Compound: Provide a polyurethane joint sealant compound.

36
37 CONCRETE PLACEMENT:

38
39 Comply with ACI 301.

40
41 FINISH OF FORMED SURFACES:

42
43 Rough Form Finish (RfFm): Provide as-cast rough form finish to formed concrete surfaces
44 that are to be concealed in finish work or by other construction, unless otherwise indicated.

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Smooth Form Finish (SmFm): Provide as-cast smooth form finish for formed concrete surfaces that are exposed-to-view, or that are covered with a coating material applied directly to concrete, or a covering material bonded to concrete such as waterproofing, dampproofing, painting, or other similar system.

Related Unformed Surfaces: At tops of wall, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces.

SLAB FINISHES:

Trowel Finish (Trw): Apply trowel finish to monolithic slab surfaces to be exposed to view, unless otherwise indicated, and slab surfaces to be covered with paint, or other thin-film finish coating system.

Nonslip Broom Finish (Brm): Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as shown on drawings or in schedules.

CONCRETE CURING AND PROTECTION:

Comply with ACI 301.

REMOVAL OF FORMS:

Comply with ACI 301

CONCRETE SURFACE REPAIRS:

Comply with ACI 301.

FIELD QUALITY CONTROL:

Subcontractor Supplied Testing: The Subcontractor shall provide the necessary testing and monitoring services for the following:

Testing services needed by the Subcontractor to control or monitor the production, transportation, placement, protection, curing or temperature of the concrete.

The use of Contractor supplied inspection or testing services shall in no way relieve the Subcontractor of the responsibility to furnish materials and construction in full compliance with the subcontract documents.

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- 1 Contractor Supplied Testing: The Contractor's Representative will perform tests during
- 2 placement and curing of the concrete. Monitoring of concrete protection and curing methods
- 3 may also occur.
- 4
- 5 Sampling and testing for quality control during placement of concrete may include any of the
- 6 tests specified in ACI 301 16.3.
- 7
- 8 END OF SECTION 03301

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SECTION 03400--PRECAST CONCRETE

PART 1--GENERAL

SUMMARY:

The Subcontractor shall provide all plant, labor, and materials required to construct and install precast concrete complete with accessories, reinforcing, and grout, as required by the drawings and these specifications.

Section Includes: Work includes, but is not limited to:

Furnish and install precast concrete as shown on the drawings.

Related Sections: Section 03301, Cast In Place Concrete

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301	Specifications for Structural Concrete for Buildings
ACI 318	Building Code Requirements for Reinforced Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C990	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A48	Standard Specification for Gray Iron Casting (R 1990)
ASTM A185	Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (AASHTO No. M31)

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION
OFFICIALS (AASHTO)

AASHTO	Standard Specification for Highway Bridges
--------	--

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1 SUBMITTALS:

2
3 Submittals include, but are not limited to the following:

4
5 Shop Drawings: Submit drawings indicating fabrication and erection requirements. Show
6 details of joints, reinforcements, inserts, and lifting devices.

7
8 See Section 01300, Submittals and the Vendor Data Schedule for additional submittal
9 requirements.

10
11 QUALITY CONTROL:

12
13 Qualifications of Workmen: Precast shall be regularly engaged in the manufacture and
14 erection of precast concrete products, having a recognized background in such work.

15
16 Codes and Standards: Comply with provisions of ACI 301 unless otherwise specified herein.

17
18 Testing: Perform design mix test and field tests in accordance with Section 03301, Cast In
19 Place Concrete, except that not less than 2 production sets of strength tests will be taken from
20 separate pours.

21
22 STORAGE AND HANDLING:

23
24 Follow recommendations of ACI 318 for precast concrete.

25
26 Lift only at designated lifting and support points by approved devices.

27
28 Protect edges from spalling, chipping, or cracking with suitable padding or wrapping.

29
30
31 PART 2--PRODUCTS

32
33 FORM MATERIALS:

34
35 Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for
36 exposed concrete surfaces with plywood, metal, or metal-framed plywood faced to provide
37 continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to
38 minimize number of joints. Provide form material with sufficient thickness to withstand
39 pressure of newly-placed concrete without visible bow or deflection.

40
41 Plywood shall comply with American Plywood Association, grade "EXT-DFPA Plyform" or
42 better.

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Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, or metal.

Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

REINFORCING MATERIALS:

Reinforcing Bars: ASTM A615 Grade 60 deformed.

Welded Wire Fabric (WWF): ASTM A185, welded steel wire fabric.

Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Use supports with sand plates or horizontal runners where base material will not support chair legs. Pumice blocks are not acceptable for rebar or wire mesh supports.

Concrete Mix: Comply with applicable requirements of Section 03301 for following concrete class:

Cement:	Type II
Class 50:	5,000 psi 28-day compressive strength
Slump:	3 in. \pm 1 in.

Metal Accessories:

Frames and Covers: Grey cast iron, ASTM A48, Class 30. Capable of withstanding AASHTO H20 truck traffic.

Vault Steps: Grey cast iron, ASTM A48, Class 30B, integrally cast into manhole sidewalls, unless otherwise indicated.

Joint Sealants: Comply with ASTM C990, Preformed Flexible Joint Sealants.

DESIGN CRITERIA:

General: All precast concrete shall be designed in accordance with ACI 318.

Loads: The precast structure shall be capable of supporting an AASHTO H20 truck axle load. All precast items shall be capable of withstanding all lifting and handling loads.

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1 FABRICATION:

2
3 General: Maintain formwork to provide complete precast concrete of the shape, lines, and
4 dimensions indicated. Provide and install chamfer strips on exterior edges.

5
6 Casting Tolerances:

7
8 Length \pm 1/2 in.

9 Width \pm 1/4 in.

10 Depth \pm 1/4 in.

11 Position of handling devices \pm 2 in.

12 Position of embedded angles to be welded between adjoining panels \pm 1 in.
13 longitudinally.

14 Deflection 1/8 in per 10 ft, but not greater than 1/2 in. between adjoining panels.

15 Squareness of Ends (vertical and horizontal alignment) \pm 1/4 in.

16
17 Finishing: Fabricate with a smooth form finish. See Section 03301.

18
19 Curing: Comply with applicable requirements of Section 03301.

20
21 Lifting: Do not lift precast units until concrete has obtained a minimum of 3,500 psi
22 compressive strength (fc') as determined by test cylinders cast on the same day. If design
23 requires a higher compressive strength before lifting the higher strength shall apply.

24
25 PART 3--EXECUTION

26
27 INSPECTION:

28
29 Before installing, verify conditions are adequate to receive precast units. Required
30 corrections to be made before proceeding with placement.

31
32 Determine field conditions by actual measurements. Double check and cross check
33 measurements.

34
35 All precast structures shall be inspected prior to placement for damage or casting deviations
36 in excess of tolerances specified.

37
38 ERECTION:

39
40 Employ only competent personnel who are properly trained to prepare, handle, and install
41 precast concrete.

42
43 Method of installation shall avoid soiling, cracking, chipping of concrete, and damage to
44 built-in items.

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- 1 Apply joint sealant material at joints of sections.
- 2
- 3 Nonshrink grout may be used for leveling or filling holes in precast sections.
- 4
- 5 FIELD QUALITY CONTROL
- 6
- 7 Surveillance will be performed by Contractor's Representative to verify compliance of the
- 8 work to the drawings and specifications.
- 9
- 10 END OF SECTION 03400

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1 SECTION 09810--POLYUREA SPRAY-ON COATING

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 The Subcontractor shall furnish all labor, materials and equipment required for preparation of
8 the surfaces for application of the polyurea spray-on coating to the designated areas including
9 installation of the geotextile liner.

10
11 Installation and application of the geotextile liner and polyurea spray-on liner will be
12 conducted per the drawings and specifications designated herein.

13
14 Section Includes: Work includes, but is not limited to:

15
16 Preparation work (i.e., cleaning and abrading) including grading and compacting of
17 the subgrade, installation of the geotextile liner and application of the polyurea spray-
18 on liner material to all designated areas.

19
20 Definitions:

21
22 Elastomeric polyurea lining includes a penetrating, three-component,
23 urethane/cementitious primer, a geotextile liner for support over unstable substrates,
24 (i.e., gravel, soil, unsound asphalt, unsound concrete), and a spray applied, high build,
25 polyurea elastomeric coating.

26
27 PERFORMANCE REQUIREMENTS:

28
29 Performance to the following criteria shall be the responsibility of the vendor/applicator.
30 Details shown in the drawing and these specifications have been provided, however, changes
31 to these details necessary to meet the performance criteria may be submitted to the Contractor
32 for approval.

33
34 Performance criteria to be met by the polyurea lining system include:

- 35
36
 - strength
 - safety
 - bonding
 - aesthetic appeal

37
38
39
40
41 Strength:

42
43 The polyurea lining system shall be strong enough to withstand extreme loading
44 conditions. This may include occasional occurrences of heavy equipment which can

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reasonably be expected to cross the lining system, (i.e., a track hoe weighing 31,000 pounds (representing the greatest concentrated load) and a crane weighing 190,000 pounds (representing the greatest total distributed load).

The lining system shall also be durable enough to accommodate traffic conditions defined as at least daily occurrences of foot traffic, normal vehicle traffic (defined as pickups or cars driven across the areas approximately four times per day).

Safety:

The polyurea lining system shall be applied in manner that is safe for both foot and vehicle traffic that may come into contact with the surface. A high friction surface shall be applied per the manufacturer's specification.

Significant buckling resulting from an improperly anchored geotextile, which creates tripping, or slipping hazards from accumulated water, snow or ice, and/or access problems shall not be allowed.

Bonding:

The polyurea lining system shall be bonded to various materials including the geotextile, road base, uncompacted gravel, miscellaneous protrusions (i.e., pipes and footings), and building foundations. The lining system shall not pull away or crack around from these surfaces due to the normal wear and traffic conditions or normal temperature fluctuations.

Aesthetic Appeal:

The polyurea lining system shall be installed in a manner that is visually acceptable to those who visit and work at the facility. The finished work shall be free of foreign material, ridges, waves, laps, sags and variations in thickness and finish. All coats shall be applied to produce a monolithic uniform liner

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein:

INEEL Emergency Preparedness Plan - Addendum 2 (ICPP [INTEC]), Latest Revision.
OU 3-13 TFIA Health and Safety Plan
AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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SUBMITTALS: Submittals include, but are not limited to the following:

See Section 01300, Submittals and Vendor Data Schedule for additional submittal requirements.

Quality Control Plan:

Submit an installation quality control plan for approval. Specific details shall be shown where spraying around structures, pipes, ditches, and other interferences.

Material Data:

Submit Manufacturer's technical specifications, installation instructions, and chemical resistance data on the geotextile liner and the materials used to anchor the geotextile to the various surfaces to which it will be attached.

Submit Manufacturer's technical specifications, installation instructions, and chemical resistance data for the polyurea spray-on liner material, including any primers, or other additional coatings as required.

Include physical and performance properties. For any data not listed in the manufacturer's standard nationally published data, the manufacturer must supply the missing data accompanied by independent testing laboratory test results which prove compliance in accordance with the referenced standard(s). All manufacturers information must be the most current available and will supersede all prior data.

Submit material data indicating compliance with the requirements of these specifications, including surface preparation and application instructions.

Submit color chart of the various colors available for the polyurea coating.

Certification:

Submit certification that the material supplied meets the Materials requirements.

Samples:

Submit, for verification purposes, 4-inch square samples of each type of geotextile liner and elastomeric polyurea lining required, applied to a rigid backing, in color and finish indicated.

Submit a 2-ft by 2-ft sample of the polyurea product with the high friction surface.

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1 Subcontractor's Qualifications:

2
3 The Subcontractor shall furnish a list of projects of similar size and complexity using
4 either a specified or similar material that they have installed and applied during the
5 last five years. Information shall include: project name, square footage, and
6 contractor contact name with contractor's address and phone number.

7
8 The Subcontractor shall furnish resumes detailing the experience of key project
9 personnel including supervisors and mechanics.

10
11 Qualifications:

12
13 Submit certification that the Subcontractor meets the requirements of the
14 "Qualifications" article of this Section.

15
16 Sample Warranty Letter

17
18 A sample warranty letter must be included with bid package or bid may be
19 disqualified.

20
21 QUALITY CONTROL:

22
23 Qualifications:

24
25 Installation shall be performed by a manufacturer approved by the Subcontractor with
26 skilled mechanics having not less than five years satisfactory experience in the
27 installation of geotextile material and application of polyurea spray-on coatings as
28 specified in this section. Subcontractor shall have completed at least three projects of
29 similar size and complexity during the last 5 years. Applicator must have a certified
30 operator operating spray equipment at all times. Refer to Part III for Spray Equipment
31 requirements.

32
33 Single Source Responsibility:

34
35 Obtain primary lining materials including primers, resins, hardening agents, finish or
36 sealing coats from a single manufacturer or as approved by the polyurea
37 manufacturer, with not less than ten years of successful experience in manufacturing
38 and installing principal materials described in this section. Provide secondary
39 materials only of type and from source recommended by manufacturer of primary
40 materials.

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1 Project Control:

2
3 The product Manufacturer shall be responsible for supervising and controlling the
4 installation of the special coatings covered by this specification.

5
6 ISO 9002:

7
8 All materials, including primers, resins, curing agents, finish coats, aggregates and
9 sealants are manufactured and tested under an ISO 9002 registered quality system.

10
11 Qualified Materials:

12
13 Product substitutions must be submitted to the INEEL Procurement Department two
14 weeks prior to bid date. Submit the following proof documents:

- 15
16 1. Third party laboratory testing data confirming that the proposed material
17 substitution meets or exceeds the performance criteria stated in Part II of this
18 specification.
19
20 2. Third party laboratory testing data confirming that the proposed material
21 substitution is a true polyurea lining system. Due to the harsh climate and low
22 temperature constraints only true polyurea systems will be accepted, no hybrid
23 lining systems.
24

25 Once the criteria stated above has been satisfied and the INEEL Project Manager
26 accepts the third party data, the proposed Product Substitution becomes a Preliminary
27 Qualified Material and is an acceptable product for bidding purposes. However, all
28 products must pass an on-site testing performance evaluation to demonstrate the
29 product will meet the performance criteria of strength, safety, bonding and aesthetic
30 appeal performed by INEEL to become a qualified and approved product for
31 application. If the product has not been previously, successfully demonstrated at the
32 INEEL, include in your base bid the cost for all materials and labor to install an
33 approximately 900-ft² demonstration plot of the Preliminary Qualified Material,
34 including all specified penetration and termination details. The demonstration will be
35 used to conduct INEEL's on-site testing. If the demonstration passes the on-site
36 evaluation test then the Preliminary Qualified Material may become the approved and
37 Qualified Material for the entire project scope detailed in this package, otherwise, it
38 will not be accepted.
39

40
41 DELIVERY, STORAGE AND HANDLING:

42
43 Materials shall be delivered to job site and promptly checked by the Subcontractor for
44 completeness and shipping damage prior to job start. Damaged material shall only be used at

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the discretion of the Contractor's Representative. Materials shall be delivered in the manufacturer's undamaged, unopened containers. Materials will not be accepted or used which exceed the manufacturers recommended shelf life. Each container shall be clearly marked with the following:

- Product name(s) and/or Numbers
- Manufacturers name
- Manufacturer date or batch code
- Component designation
- Product Mix Ratio
- Date which material will exceed shelf life
- Manufacturer's Health and Safety Information
- CHEMTREC Emergency Response Information

All materials used shall be factory pre-weighted and prepackaged in single, easy to manage batches to eliminate on site mixing errors. No on-site weighing or volumetric measurements will be allowed.

Storage and handling of the materials shall conform to the manufacturer's recommendations and shall be done in such a manner as to prevent damage to any part of the containers, product, personnel and environment. All materials shall be carefully handled and stored to prevent inclusion of foreign materials.

Materials shall be stored according to the manufacturer's instructions, with seals and labels intact and legible. Materials shall be stored in a dry, enclosed area protected from exposure to moisture. Temperatures shall be maintained within the manufacturer's specified required range. Materials outdated as indicated by the manufacturer's shelf life specifications shall not be used.

The Subcontractor shall be responsible for materials furnished by him, and shall replace, at his own expense, such materials that are found to be defective in manufacture or that have become damaged in transit, handling or storage.

Preventative spill measures shall be required and implemented per the manufacturer's specifications. Preventative spill measures and spill response activities shall be conducted in accordance with the project health and safety plan and the INEEL Emergency Preparedness Plan - Addendum 2 (ICPP [INTEC]), Latest Revision.

JOB CONDITIONS:

The purpose of applying the geotextile and polyurea spray-on liner is to seal approximately 5 acres of unpaved surface. Refer to subcontract drawings for the locations of the areas to be sealed.

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1 Work control zones shall be established and the specific configuration and distances from the
2 application area will be per the manufacturer's technical specifications or the Contractor's
3 requirements.

4
5 Appropriate barricades and signs shall be utilized to establish an effective access control to
6 the application area. "No Smoking" and other warning signs shall be posted as necessary in
7 the work area during application of the lining system.

8
9 Only trained, authorized persons equipped with specified personal protective equipment
10 (PPE) will be allowed to enter the work control zone. Applicators shall wear and utilize all
11 safety equipment as recommended in the Material Safety Data Sheets and in the OU 3-13
12 TFIA Health and Safety Plan when handling, mixing and applying the lining system.

13
14 Open fires and spark producing equipment shall not be used in or near work areas during the
15 application of the lining system.

16
17 Numerous small buildings and protrusions (i.e., valve boxes, wells, piping, etc.) are located
18 in the area to be sealed. Various types of surfaces to which the spray-on liner shall be sealed
19 include gravel, concrete, asphalt, wood and metal.

20
21 Work unrelated to site preparation, geotextile installation or application of the spray-on liner
22 shall not occur during or within 8 hours in close proximity to areas where these activities are
23 being conducted.

24
25 Defects:

26
27 Conditions that may be detrimental to start up, completion or performance of the
28 specified work shall be reported in writing to the Contractor prior to commencing
29 work. Work shall not be started until defects are corrected or specific approval has
30 been given in writing.

31
32 Costs incurred that are associated with damage from negligence of or inadequate protection
33 shall be the sole responsibility of the Subcontractor.

34
35 The Subcontractor shall not apply the geotextile or polyurea spray-on liner to areas
36 containing standing water or snow.

37
38 WARRANTY:

39
40 The Subcontractor and manufacturer shall furnish a standard joint and several, written
41 warranty covering materials and workmanship for a period of five (5) full years from date of
42 installation. The labor and material warranty shall include loss of bond and wear-through of
43 the seal coat from normal use. A sample warranty letter must be included with bid package
44 or bid may be disqualified.

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PART 2--PRODUCTS

GENERAL:

The materials supplied under these specifications shall be designed and manufactured specifically for the purpose of this work and shall have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes.

MATERIALS:

The Polyurea lining system is comprised of a penetrating, three-component, urethane/cementitious primer, a geotextile liner for support over unstable substrates, i.e., gravel, soil, unsound asphalt, unsound concrete, and a high build, polyurea elastomeric membrane.

Geotextile Liner:

Prior to the polyurea liner installation, a geotextile liner shall be installed to protect the liner from the subgrade. The geotextile liner shall meet the minimum physical requirements indicated in Table 1 below or shall be an Enkadrain 961 1 liner or approved equal.

Table-1 Minimum Geotextile Physical Properties

Typical Properties	Test Method	Requirements
Grab Tensile Strength	ASTM D4632	250 lbs
Grab Elongation	ASTM D4632	50%
Puncture Strength	ASTM D4833	150 lbs
Mullen Burst	ASTM D3786	460 psi
Trapezoidal Tear	ASTM D4533	100 lbs
Apparent Opening Size	ASTM D475 1	100 US Std Sieve
Permittivity	ASTM D4491	1.20 sec ⁻¹
Permeability	ASTM D4491	0.30 cm/sec
Water Flow Rate	ASTM D4491	85 gpm/ft ²
UV Resistance (% retained after 500 hours)	ASTM D4355	70%

Primer:

Primers shall be obtained from the selected polyurea lining system vendor and shall be an integral part of the polyurea lining system application. Primers for the various substrates will be selected and approved by the polyurea lining system manufacturer's technical representative.

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Elastomeric Polyurea Liner:

The polyurea elastomer shall be formed by reacting an amine resin with an isocyanate. The amine resin component shall not include polyol. The reacted polyurea elastomer shall have the following application properties.

- a. Gel Time 3 to 8 seconds
- b. Cured for foot traffic 60 minutes
- c. Cured for water exposure 10 minutes

Physical Properties: Provide a lining system in which physical properties of topping, when tested in accordance with standards or procedures referenced below, are as follows:

Tensile Strength 2,300 psi
(ASTM D-638)
Hardness..... .46
(ASTM D-2240/Shore D Durometer)
Bond Strength >450 psi
(ASTM D-4541) (100% concrete failure)
Abrasion Resistance 0.02 gm max. weight loss
(ASTM D-4060, Taber Abrader CS-17 wheel)
Elongation400
(ASTM D-638)
Tack Free Time Less than 2 minutes
(at 77°F/25°C)
Hydrostatic Pressure Resistance Test..... Pass
(ASTM D-5385 / 231 ft. of water)
Low Temperature Flexibility Test -20°F Pass
(ASTM D-1970/ 180° Bend)

Approved polyurea lining systems include Semstone 403 (Stonflex HPE) or Sherwin Williams Foamseal V9256/FSA64 or approved equal.

Color:

Colors will be specified upon receipt of the Manufacturer's color chart.

PART 3--EXECUTION

GENERAL

The installation and application techniques provided in this section are general guidelines. The manufacturer's recommendations shall be used as applicable.

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The geotextile and each component of the polyurea spray-on liner will be installed in compliance with the manufacturers written installation instructions. Mixing and installation methods, cure times and environmental regulations shall be strictly adhered to.

SURFACE PREPARATION:

All Surfaces:

Test for substrate temperature by using a surface dial thermometer or equal. Temperature shall be within temperature parameters recommended by the lining material manufacturer.

Inspect for contamination, such as oil, grease, or chemical spills. Contamination must be removed prior to application of lining.

Areas found to be unsound or non-durable must be brought to the attention of the Contractor.

For thorough instructions regarding preparation of the various types of surfaces encountered, consult manufacturer.

Compressed air or water used for surface preparation shall be free of contaminants. Oil and water filter/separators shall be installed in the air supply.

Prior to coating all materials except for the geotextile liner over gravel, surfaces shall be vacuumed or blown down with compressed air to remove residual dust.

Simultaneous coating application and surface preparation operations shall not be conducted where possible contamination of the coating may occur.

All areas that will not be coated should be properly protected prior to the commencement of surface preparation activities. The tank farm fence shall be protected from overspray so that other activities outside or inside the fence shall not be affected.

Surfaces which are to be covered by materials specified in this specification shall have all rough edges and projections removed. The entire surface to be lined shall be clean, dry, and free of debris or other surface contaminants and swept thoroughly.

Preparation of Earth Subgrade:

The surface of the subgrade shall be prepared by excavating and grading to the elevations and sections as shown on the drawings and as designated in the field. The prepared subgrade shall be free from debris, cobbles, rubbish and organic

material. The surface of the completed subgrade shall be compacted in accordance with Division 2 Section, "Earthwork" and shall be smooth, uniform and free from sudden changes in grade.

Preparation of Geotextile Surfaces:

Before application to a geotextile surface, the geotextile shall be free of loose debris or any other contaminant that would decrease adhesion between the coating system and the geotextile.

Preparation of Concrete Surfaces:

Concrete substrate shall be dense, free of voids, fins, honeycombs and other imperfections. Horizontal surfaces shall have a "once over" steel trowel finish (wood float, broom or machine trowel finishes are unacceptable). Finish concrete to the required grade, less allowance for overlayment/ thickness. A vapor barrier shall be present for concrete on or below grade to prevent osmotic pressure forces from affecting adhesion of overlayment. Cure concrete 30 days minimum and conduct the following tests prior to application of overlayment:

Concrete preparation shall be by mechanical means and may include use of a scabblor, scarifier, shot blast, sand blast, high pressure water or air blast, or sand injected water blast machine for removal of bond inhibiting materials such as curing compounds or laitance to produce a rough and clean surface finish. Care shall be taken to ensure all loose material is removed completely.

1. Test for "bird baths", if complete drainage is critical, by flooding horizontal surfaces with water and marking unacceptable areas. Unacceptable areas are to be corrected prior to application of overlayment.
2. Test for unacceptable moisture content in concrete by the "plastic sheet" method (Ref. ASTM D-4263). The number of test sites shall be representative of the scope of work.
3. Test for acceptable concrete surface tensile strength of 200 psi minimum by using a "pull-out test" (Ref. ASTM D-4541) in which a 0.8 inch diameter dolly is bonded to the concrete with polymer adhesive and a 1.0 inch diameter hole is cut through excess adhesive into concrete. The number of test sites shall be representative of the scope of work.
4. Control joints shall be treated by lining manufacturer to assure bridging of potential cracks and to maintain monolithic protection.

5. Cold joints or construction joints shall be treated by lining manufacturers to assure bridging potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.
6. Vertical and horizontal expansion/contraction joints shall be treated by installing backer rod and compatible sealant before lining is installed to assure bridging of joint movement and to maintain monolithic protection.
7. Cracks in vertical or horizontal concrete substrates shall be treated by lining manufacturer to assure bridging of cracks and to maintain monolithic protection.
8. Inside comers shall be treated with either an elastomeric or epoxy mortar radius (1/2" minimum) prior to application of the lining.
9. Outside comers shall be ground to remove sharp comers. Rout all cracks and joints to form a "V" groove.

Preparation of Steel Surfaces:

Surrounding steel preparation shall be abrasive blasted to near white metal, according to SSPC-SP10.

All steel surfaces shall have a surface profile in the range of 3 to 5 mils. The surfaces of heavily corroded steel, containing grooving or pinholes, shall be opened up and sharp edges shall be removed.

All metal surfaces that have been prepared shall be coated within the same day. No metal shall be coated that develops visible rust bloom.

Preparation of Wood Surfaces:

Wood substrate shall be clean, sound and free of all bond inhibiting contaminants such as dirt, grease, oil, wax, etc.

Wood surfaces shall be hand or power tool sanded to provide a surface free of loose material and contamination. Wood should have roughened surface prior to primer application.

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1 MATERIAL INSTALLATION:

2
3 General:

4
5 Materials shall be installed per the manufacturer's written instruction. Any deviation
6 from these instructions shall be conducted only under the direction of the Contractor.

7
8 Geotextile Liner Installation:

9
10 The geotextile liner shall be placed over the prepared surfaces to be lined in such a
11 manner to assure minimum handling. The geotextile shall be placed, and anchored to
12 the subsurface per the manufacturer's written instructions to eliminate flapping and
13 wrinkles during application of the polyurea spray-on liner.

14
15 The geotextile liner shall be attached to all structures and other protrusions in
16 accordance with the details shown on the drawings. The lining shall be closely fitted
17 around inlets, outlets, and other projections through the lining. Weather reports shall
18 be obtained to ensure that proper installation conditions specified by the manufacturer
19 will exist during the installation schedule. Any portion of lining damaged during
20 installation by any cause shall be removed or repaired as specified hereinafter.

21
22 Surface Priming:

23
24 All properly prepared substrates shall be primed using appropriate manufacturer's
25 primers with strict adherence to installation the manufacturer's technical
26 specifications.

27
28 All primed surfaces shall be inspected prior to the application of the polyurea coating
29 to ensure that a pinhole free surface is obtained. Additional primer coats may be
30 required.

31
32 All bug holes shall be filled as part of the priming process.

33
34 Polyurea Coating Spray Equipment:

35
36 The type and condition of the spray equipment is critical to produce a high quality
37 polyurea lining with the proper physical properties. Use of any spray equipment that
38 does not comply with this section of the specification is strictly prohibited without the
39 written approval of an authorized technical representative.

40
41 Spray pump and heating unit shall be Gusmer Model H-3500 or Model H-2000, as
42 manufactured by Gusmer, Lakewood, NJ, (201) 370-9000. Other Gusmer models
43 may be acceptable for specific projects subject to written approval by the authorized
44 polyurea manufacturer's technical representative.

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Spray gun shall be a Gusmer Model GX7 or GX7-400 as manufactured by Gusmer.

Spray gun mixing module shall have two ports of entry for each component of the lining system. The spray gun mixing module shall be a Gusmer module compatible with the Gusmer GX7 or GX7-400 gun. No other mixing module will be acceptable without the written approval of an authorized technical representative.

Drum heaters shall be required to heat material if material temperature is below 65°F.

Polyurea Spray-On Liner Application:

Application of the polyurea coating shall be conducted with strict adherence to temperature requirements and installation instructions. The polyurea coating shall be applied to a clean, dry surface during periods of favorable temperature and humidity conditions.

Allowable recoat intervals shall be observed between the initial application and any subsequent overcoats.

Spray apply elastomeric polyurea lining at a 1:1 ratio over properly cured primer with strict adherence to manufacturer's installation procedures including but not limited to:

1. Primary Heat: 155°F
2. Hose Heat: 150°F
3. Spray Pressure: 1,200-2,000psi with no greater than 300 psi pressure differential between sides.

All surfaces to be lined with the polyurea coating shall receive no less than 125 mils in a single coat.

All lining application shall be applied in two (2) or more build passes, each in the opposite spray pattern direction.

Good painting practice shall be used to produce a high-quality application that has uniformity of thickness and is free of excessive run, sags, surface contaminants, overspray, or dry spray.

High Friction Surfacing:

A high friction surface shall be achieved using the manufacturer's recommended aggregate and installation method. The surface friction coefficient shall be no less than 0.9. A 2-A by 2-ft sample of the polyurea product with the high friction surface shall be submitted to the Contractor for approval.

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1 CURING, CLEANING AND PROTECTION:

2
3 Curing:

4
5 All materials requiring curing times will remain protected and curing will be
6 conducted under the manufacturers written instructions. Care will be taken to prevent
7 contamination to the product following installation prior to completion of the curing
8 process. Newly coated areas shall be protected from traffic or other activities for a
9 minimum of 1 hour.

10
11 Protect polyurea lining system from damage and wear during construction operation.
12 Where temporary covering is required for this purpose, comply with manufacturer's
13 recommendations for protective materials and method of application. The
14 Subcontractor is responsible for protection and cleaning of surfaces after final coats.

15
16 Cleanup:

17
18 Remove any temporary covering and clean the polyurea lining system just prior to
19 final inspection. Use cleaning materials and procedures recommended by lining
20 manufacturer.

21
22 During the progress of work, the Subcontractor shall remove from the site all
23 discarded decontaminable materials designated in this section including rubbish, cans,
24 drums and rags at the end of each workday and shall be disposed of per the project
25 Waste Management Plan.

26
27 The Subcontractor shall clean all liner equipment, brushes, sprayers, and related
28 materials as recommended by the manufacturer, at the end of each day.

29
30 Upon completion of the spray-on liner application, the Subcontractor shall clean
31 splattered surfaces, remove splatters by proper methods of wiping and scraping, using
32 care not to scratch or otherwise damage finish surfaces. Repainting of splattered
33 surfaces may be required if finishes are damaged.

34
35 At the completion of work, the Subcontractor shall touch-up, restore, and/or recoat
36 surfaces of unacceptable work.

37
38 WORKMANSHIP:

39
40 The finished work shall be free of foreign material, ridges, waves, laps, sags and variations in
41 thickness and finish. All coats shall be applied to produce a monolithic uniform liner

42
43 FIELD QUALITY CONTROL:

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1 Inspection and surveillance will be performed by the Contractor's Representative to verify
2 compliance of the work to the drawings and specifications.

3
4 The timely and daily completion of inspection documents by the subcontractor, or his
5 designate is required throughout the course of the job. These forms should record the
6 following inspections:

- 7
- 8 • Surface preparation
- 9 • Surface temperature
- 10 • Dew point of substrate
- 11 • Temperature and humidity of ventilating air
- 12 • Batch numbers and identification of mixed coating components
- 13 • Application rate of individual coats
- 14 • Recoat intervals
- 15 • Location and repair of defects (i.e., pinholes)
- 16 • Determination of degree of cure
- 17

18 The Contractor may engage services of an independent testing laboratory to sample materials
19 being used on the job site. Samples of materials may be taken, identified and sealed, and
20 certified in the presence of the Contractor

21
22 Testing laboratory may perform tests for any of characteristics specified, using applicable
23 testing procedures referenced herein and in manufacturer's product data.

24
25 All coating inspection instruments, inspection standards, calibration standards and testing
26 materials shall be in good working order, appropriate for the use intended and where
27 required, have been calibrated within 12 months of their use or as specified in the instrument
28 calibration specification. The Contractor shall have access to all required calibration
29 certificates.

30
31 The right is reserved to invoke the following material testing procedure at any time, and any
32 number of times during period of lining application.

33
34 If test results show materials being used do not comply with specified requirements, the
35 Contractor may direct the Subcontractor to stop work; remove non-complying materials; pay
36 for testing; reapply lining materials to properly prepared surfaces which had previously been
37 coated with unacceptable materials.

- 38
- 39 1. Gel Test: Conduct a field gel test on a vertical surface to confirm 6 to 8 second gel
40 time.
- 41
- 42 2. Thickness Test: Apply lining material onto a polyethylene board with the number of
43 spray gun passes to be used during installation. After the material cures for a few
44 minutes, remove the material from the board and measure thickness. If thickness is

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- 1 not within the nominal specified range, adjust number of spray gun passes and repeat
2 test.
3
4 3. Retained Field Samples: Return field samples used for thickness test to lining
5 manufacturer, who shall retain samples as part of the manufacturer's project record.
6
7 Manufacturer's representative must submit a letter of compliance and warranty upon final
8 inspection.
9
10
11 **END OF SECTION 09810**

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SECTION 15401--UNDERGROUND PIPING AND PLUMBING SYSTEMS

PART 1--GENERAL

SUMMARY:

The Subcontractor shall furnish and install all equipment, materials and supplies and perform all work and operations necessary for furnishing and installing the underground piping and plumbing systems and appurtenances to complete the **work** as shown on the subcontract drawings and specified herein. Upon completing installation of the piping systems, the Subcontractor shall operate and test as specified hereinafter to verify that the systems are properly installed and operate as required.

Section Includes: Work includes, but is not limited to:

Furnish and install all valves, tubing, pipe, flanges, traps, fittings, couplings, strainers, hangers, supports, insulation, and appurtenances as required to complete the work as shown on the subcontract drawings for the following systems:

Underground Storm Drain Piping
Storm Drain Lift Station Piping

SUBMITTALS:

Shop Drawings: Shop drawings shall include the following:

Principal dimensions and details of construction.
Sizes and location of piping and components.

Maintenance Manuals: Provide maintenance and operation manuals with complete parts lists for valves and assemblies.

See Section 01300, Submittals and Vendor Data Schedule for additional submittal requirements.

QUALITY CONTROL:

Qualifications: Underground piping and plumbing shall be furnished and installed by a firm qualified, accredited and regularly engaged in this type of work, and shall maintain shop and facilities for fabrication and maintenance of subject equipment.

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Items of Any One Classification: Items which are used in quantity, such as valves, specialties, accessories, fittings, etc., shall in each case be the product of one manufacturer, and shall be used only for the services recommended by the manufacturer.

Pipe Joints: Any leaks, revealed by the pressure testing procedure, shall be repaired at no additional cost to the Contractor. Leaks in piping or joints shall be repaired per the manufacturer's written instructions.

Testing: Force main piping shall be hydrostatically pressure tested and inspected in accordance with ANSI B31.1. No testing is required for plastic and metal gravity piping.

MATERIAL DELIVERY, STORAGE AND HANDLING:

Delivery: Subcontractor shall ensure that all materials are delivered in a new, undamaged and protected condition.

Receiving Inspection: Each shipment shall be inspected by the Subcontractor prior to acceptance. If damage is found or any material, identification, and/or documentation is missing, this fact shall be promptly reported to the delivering carrier(s), the manufacturer and the Contractor's Representative.

Storage and Handling: Materials shall be resealed and repacked after inspection, and shall be stored in its original protective packing, or its equivalent. The Subcontractor shall ensure that materials are stored in a manner to provide protection against damage, atmospheric corrosion and contamination.

PART 2--PRODUCTS

GENERAL:

All materials, products and equipment shall be as manufactured by the manufacturer specified in this section, or approved equal.

PIPE AND FITTINGS:

Ductile Iron Pipe and Fittings: To be used inside the lift station, and attached to valves or other structures. Pressure pipe and fittings shall be ductile iron pipe Class 200 for 8" lines, flanged, and conform to the mechanical properties of ANSI/AWWA C151/A21.51, UL Listed, cement lined per AWWA C104/A12.1.4 and have the manufacturers standard asphalt coating outside. Fittings, eyes reducers, elbows shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

Service: Flanged joints shall be used for all above ground applications and mechanical joints shall be used for all underground applications of ductile iron pipe.

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Plastic Piping: Underground plastic pressure and gravity piping shall be Class 100 (DR 25) polyvinyl chloride (PVC) per ASTM D1784 and ASTM D3139, and meeting AWWA C900 requirements. Normal operating design pressure is 20 psi.

Metal Piping: Underground metal gravity piping shall be 16-gage minimum galvanized corrugated steel pipe, unless otherwise specified, with standard gasketed or o-ring connection bands at all joints (see Section 02430).

PART 3--EXECUTION

INSTALLATION OF ALL SYSTEMS:

General: Shall be in conformity with the applicable requirements of the Uniform Plumbing Code.

PIPELINES:

Underground Pipelines: Pipe shall be bedded in 4 in. of sand minimum or other approved granular material.

Install pipe to uniform pitches between points for which elevations are established. Use level or other approved method to accomplish this. Provide bends or elbows for changes in directions. One-quarter bends shall be long sweep type.

Between bends or elbows, lines shall be straight, free from irregularities, and have smooth interior surfaces.

Anchorage against slippage shall be provided by means of concrete or masonry piers, tie rods and pipe clamps, or other approved means. Joints shall be made accessible for inspection and repair prior to testing and backfilling.

Pipe and Equipment Identification and Valve Tags:

After installation, all pipelines and equipment shall be identified by tagging with their line number or designation as shown on the drawings. The tag shall be fabricated from 24 gage, ¾ in. wide, 3-in. long, AISI Type 303 or 304 stainless steel metal strip with 3/16 in. high letters stamped in the metal surface. Tagging shall be done as shown on the drawings.

Locator Ribbon: See Section 02200 for buried pipe identification ribbon requirements.

FIELD QUALITY CONTROL:

Subcontractor Supplied Testing: All testing shall be witnessed by the Contractor's Representative.

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- 1 The Subcontractor shall furnish temporary connections to services for testing.
- 2
- 3 Tests shall be conducted before making final connections to equipment.
- 4
- 5 Contractor Inspection: Surveillance will be performed by Contractor's Representative to
- 6 verify compliance of the work to the drawings and specifications.
- 7
- 8 END OF SECTION 15401

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1 SECTION 15480--STORMWATER LIFT STATION

2
3 PART 1--GENERAL

4
5 WORK DESCRIPTION:

6
7 Install a precast, concrete lift station in accordance with the plans and specifications.

8
9 Furnish and install 2 submersible stormwater pumps and all associated piping, valves and
10 wiring.

11
12 RELATED SECTIONS:

13
14 16000 Electrical General Provisions

15
16 QUALITY CONTROL:

17
18 Pump Warranty: The pump manufacturer shall warrant the units being supplied to the owner
19 against defects in workmanship and material for a period of five (5) years or 10,000 hours
20 operation and service. The warranty shall be printed in form and apply to all similar units.

21
22 Local Pump Service Facility: At the time of bidding, there shall be a fully accredited service
23 facility within 300 miles of the project site having factory trained technicians and a full stock
24 of repair parts for a complete overhaul of the proposed pumps.

25
26 Experience: The pump manufacturer shall have a minimum of 200 units of similar type
27 pumps, installed and operating for no less than five (5) years in the United States.

28
29 Site Tests: The pumps shall be tested at start-up. Voltage, current, **and** other significant
30 parameters shall be recorded. The Manufacturer shall provide a formal test procedure and
31 forms for recording data. See Vendor Data Schedule.

32
33 A Construction Component (CC) test of the lift station shall be performed to test for
34 operability and function.

35
36 SUBMITTALS:

37
38 The Subcontractor shall supply Submittal Drawings, Operating and Maintenance Instruction
39 Manuals and Parts Lists.

40
41 Standard submittals will consist of:

42
43 Pump Outline Drawing
44 Control Data

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1 Access Frame
2 Typical Installation Guides
3 Technical Manuals
4 Parts List
5 Pump Controller Electrical Schematics
6 Shop Drawings
7 Construction Component (CC) Test Procedures
8

9 See Section 01300, Submittals and Vendor Data Schedule for additional submittal
10 requirements.
11

12 PART 2--PRODUCTS 13

14 The pumps and electrical motors shall be a centrifugal, non-clog, submersible, solids
15 handling, sewage pump as manufactured by Aurora/Hydromatic or approved equal. The
16 pumps must be explosion proof. Each pump shall be equipped with a 7 ½ hp maximum,
17 submersible electric motor connected for operation on a 460 volts, 3 phase, 60 hertz, 3 wire
18 service, with 30 ft of UL Listed cord approved for submersible applications. The power cord
19 shall be sized according to NEC and ICEA standards, and have MSHA Approval. The pump
20 shall be supplied with a mating cast iron 6-in. discharge elbow and be capable of delivering
21 920 gpm at 14 ft TDH. Each unit shall be fitted with approximately 25-ft. of a Grip Eye
22 System for use with portable cable hoist with adequate strength to permit raising and
23 lowering the pump. A stainless steel cable shall be used in place of chains. The pump shall
24 be capable of passing a 3-in. solid. The pumps shall be supplied with either an oil cooled or
25 air-cooled motor. Pumps shall be Hydromatic S6AX, 10.25 in. impellar, 870 rpm, or
26 approved equal.
27

28 The pumps shall be controlled by the use of Milltronics Hydroranger I ultrasonic fluid level
29 sensing device or approved equal which will detect the level of the stormwater in the wet
30 well and turn the pumps on or off, and control alarm signals. The Hydroranger I shall be
31 programmed to alarm upon level out of range or loss of echo. The pumps shall alternate in
32 pumping. At high levels, both pumps shall operate simultaneously.
33

34 Pump Design: The pumps shall be capable of handling raw, unscreened stormwater. The
35 discharge connection elbow shall be permanently installed in the wet well along with the
36 discharge piping. The pumps shall be automatically connected to the discharge connection
37 elbow when lowered into place, and shall be easily removed for inspection or service. There
38 shall be no need for personnel to enter pump well. Sealing of the pumping unit to the
39 discharge connection elbow shall be accomplished by a simpler linear downward motion of
40 the pump. A sliding guide bracket shall be an integral part of the pumping unit. The entire
41 weight of the pumping unit shall be guided by no less than two (2) guide bars and pressed
42 tightly against the discharge connection elbow with metal to metal contact. Pump service
43 shall be available within a 300-mile radius of Idaho Falls, Idaho. Sealing of the discharge
44 interface by means of a diaphragm, O-Ring, or other devices will not be acceptable. No

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1 portion of the pump shall bear directly on the floor of the sump. The pump, with its
2 appurtenances and cable, shall be capable of continuous submergence underwater without
3 loss of watertight integrity to a depth of 65 Et.
4

5 PERFORMANCE CURVES:
6

7 In no case shall the required horsepower at any point on the performance curve exceed the
8 horsepower of the motor when using any of the impellers available for use with the proposed
9 pump. All centrifugal pumps shall have a continuously rising curve.
10

11 ADDITIONAL PUMP MOTOR CHARACTERISTICS:
12

13 For economy of sizing and operating auxiliary generator standby power, the pump motor
14 shall have NEC locked-rotor code letter E. NEC code letters F and greater will not be
15 acceptable.
16

17 ACCESS FRAME AND COVER:
18

19 Furnish and install one Bilco Access Frame and cover, Type J H-20, in aluminum material,
20 rated for AASHTO H-20 wheel loading, complete with hinged and flush locking mechanism,
21 and upper guide holder. The frame shall be securely placed, mounted above the pumps. The
22 frame shall be provided with sliding nut rails to attach the accessories required. Lower guide
23 bar holders shall be integral with the pump discharge connection. Guide bars shall be of at
24 least standard weight galvanized steel pipe of the size specified by the products manufacturer.
25 Doors shall be of skid proof design. All hardware which is used where it will be exposed in
26 the wet well shall be stainless steel. The top of the covers shall be labeled "STORM
27 DRAIN", and an identification tag labeled. Labels shall be installed or attached per Conduct
28 of Operation Manual, Chapter XVIII, copy in Appendix B of this specification.
29

30 CONTROLS:
31

32 The installation of the controls system shall be performed and tested by a Manufacturer's
33 Representative under the supervision and at the expense of the Subcontractor.
34

35 Furnish and install one duplex, 7 ½ HP, 3 phase, 460 V, Pump Control Panel in a gasketed
36 NEMA 3R, dead front, door-in-door enclosure for mounting on framing channel. For each
37 pump there shall be included: 480 V circuit breaker, starter, overload relays, Hand/Off/Auto
38 switch, intrinsically safe pump controller with pump alternator, pump run light, and running
39 time meter. The controller shall open an electrically operated drain valve upon pump
40 shutdown and close the drain valve upon pump startup. The controller shall also have: a
41 weatherproof, 100 W high level alarm light, audible alarm with silence pushbutton, and panel
42 powered contact, an anticondensate heater and thermostat, a secondary lightning arrestor, a
43 phase monitor relay, a common disconnect switch with a lever through the inner door for the

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power breakers, receptacle, and a Milltronics Hydorranger I Ultrasonic Level Controller with a remote transducer and cable. The pump control Panel shall be U.L. Listed.

HDL BALL CHECK VALVE:

Furnish and install two Ball Check Valves. Manufacturer shall be FLYGT or GA Industries or equal. The valve shall consist of three components; body, cover and ball (one moving part). The design of the valve shall be such that it keeps solids, stringy material, grit, rags, etc., moving without the need for back flushing. In the operating mode, the ball shall not significantly impede flow through the valve, and shall be a full port valve able to provide an unobstructed flow path equal in cross sectional area to the 8 in. pipe. It shall be non-clog. There shall not be outside levers, weights, springs, dash pots or other accessories required for a swing (clapper) type check valve. The ball shall be hollow steel with an exterior or nitrile rubber, it shall be resistant to grease, petroleum products, animal and vegetable fats, diluted concentrations of acids and alkalines (pH 4-10), tearing and abrasion. The body and cover shall be of gray cast iron. Valves shall have flanged connections in accordance with AISI B16.1, Class 125.

DRAIN VALVE:

Furnish and install one ball valve with electric actuator. The ball valve shall be 1-1/2 inch with carbon steel body, chrome plated carbon steel ball and stem, screwed pipe ends and Buna seats and body seals. The electric actuator shall be sized for infrequent operation and dirty liquids. The electric actuator shall be powered by a reversing AC motor and shall have two internal, independently adjustable travel limit switches. The actuator shall have a permanently lubricated gear train and self-lubricated bearings. Upon valve failure, it shall "fail" closed. The actuator shall be housed in an enclosure that is both water-tight and Class I, Division 2, Group C and D rated. The actuator enclosure shall have thermostatically controlled heater. The manufacturer shall be Worcester Controls Series 44 Ball Valve or approved equal.

PART 3--EXECUTION

Stormwater lift station shall be installed in accordance with the manufacturer's recommendations. Backfill around lift station shall be "compacted backfill" in accordance with Section 02200 Earthwork.

Pipe and Equipment Identification Tags:

After installation, all pipelines, pumps and valves shall be identified by tagging with their line number or designation as shown on the drawings. The tag shall be fabricated from 24 gage, 3/4 in. wide, 3-in. long, AISI Type 303 or 304 stainless steel metal strip with 3/16 in. high letters stamped in the metal surface. Tagging shall be done as shown on the drawings.

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1 TRAINING:

2
3 The Subcontractor shall provide training on the operation and maintenance of the pumps and
4 lift station for the Contractor's Stormwater Operators.

5
6 FIELD QUALITY CONTROL:

7
8 Surveillance of the installation will be performed by the Contractor's Representative to verify
9 compliance of the work to the drawings and specifications.

10
11 END OF SECTION 15480

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1 SECTION 15481—SUMP PUMP AND ACCESSORIES

2
3 PART 1--GENERAL

4
5 WORK DESCRIPTION:

6
7 Furnish and install 1 submersible sump pump, pump controller and totalizer; and all
8 associated piping, conduit, wiring and ultrasonic level switches.
9

10 RELATED SECTIONS:

11
12 16000 Electrical General Provisions
13

14 QUALITY CONTROL:

15
16 Local Pump Service Facility: At the time of bidding, there shall be a fully accredited service
17 facility within 300 miles of the project site having factory trained technicians and a full stock
18 of repair parts for a complete overhaul of the proposed pump.
19

20 Experience: The pump manufacturer shall have a minimum of 200 units of similar type
21 pumps, installed and operating for no less than five (5) years in the United States.
22

23 Site Tests: The pump shall be tested at start-up.
24

25 A Construction Component (CC) test of the sump pump shall be performed to test for
26 operability and function. See Vendor Data Schedule.
27

28 SUBMITTALS:

29
30 The Subcontractor shall supply Submittal Drawings, Operating and Maintenance Instruction
31 Manuals and Parts Lists.
32

33 Standard submittals will consist of:
34

35 Pump Outline Drawing
36 Control Data
37 Access Frame
38 Typical Installation Guides
39 Technical Manuals
40 Parts List
41 Pump Controller Electrical Schematics
42 Shop Drawings
43 Construction Component (CC) Test Procedures
44

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See Section 01300, Submittals and Vendor Data Schedule for additional submittal requirements.

PART 2--PRODUCTS

The pump and electrical motor shall be a submersible, solids handling, sump pump as manufactured by Ebara or approved equal. The pump shall be equipped with a ½ hp submersible electric motor for operation on a 115 volts, 1 phase, 60 hertz service, with UL Listed cord approved for submersible applications. The power cord shall be sized according to NEC and ICEA standards. The electric motor shall have internal overload protection with automatic reset. The pump shall be capable of delivering 35 gpm at 25 ft of head and passing a 3/8 in. solid. The pump discharge line shall be 1-1/2 FPT. The pump shall be an Ebara model 40P707U6.6S with extra long power cord or approved equal.

The pump controller shall use Gems ultrasonic level switches with the remote electronics option or approved equal to control the level of the water in the sump and initiate a high sump alarm.

Totalizer: The totalizer shall be capable of recording total flow and flow rates from 5gpm minimum to 50 gpm maximum within 2% accuracy. The totalizer shall have 1 in. NPT connections and shall be a direct mechanical readout. The totalizer shall be a SeaMetrics M-Series MT-1 or approved equal.

Polyethylene Pipe: The discharge line from the sump pump shall be 1-1/2 in. polyethylene tubing using mechanical joints to connect to the sump pump and above ground piping. The polyethylene pipe shall conform to the requirements of AWWA C901. The polyethylene pipe shall be Driscopipe Ultra-line or approved equal.

PERFORMANCE CURVES:

In no case shall the required horsepower at any point on the performance curve exceed the horsepower of the motor when using any of the impellers available for use with the proposed pump.

CONTROLS:

The installation of the controls system shall be performed and tested by a Manufacturer's Representative under the supervision and at the expense of the Subcontractor.

Furnish and install one simplex, ½ HP, 1 phase, 115 V, Pump Control Panel in a gasketed NEMA 3R, dead front, door-in-door enclosure for mounting on framing channel. The controller shall include: 120 V circuit breaker, starter, Hand/Off/Auto switch, intrinsically safe pump controller, pump run light, and running time meter. The controller shall also have: a weatherproof 100 W high level alarm light, audible alarm with silence pushbutton, an

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1 anticondensate heater and thermostat, a secondary lightning arrestor, a common disconnect
2 switch with a lever through the inner door for the power breaker; and Gems ULS-10
3 Ultrasonic Level Switches with a remote electronics, sensors and manufacturer supplied coax
4 cables. The Pump Control Panel shall be U.L. Listed.

5
6 PART 3--EXECUTION

7
8 The sump pump and accessories shall be installed in accordance with the manufacturer's
9 recommendations.

10
11 Pipe and Equipment Identification Tags:

12
13 After installation, all pipelines and equipment shall be identified by tagging with their line
14 number or designation as shown on the drawings. The tag shall be fabricated from **24** gage,
15 $\frac{3}{4}$ in. wide, 3-in. long, AISI Type 303 or 304 stainless steel metal strip with 3/16 in. high
16 letters stamped in the metal surface. Tagging shall be done as shown on the drawings.

17
18 FIELD QUALITY CONTROL:

19
20 Surveillance of the installation will be performed by the Contractor's Representative to verify
21 compliance of the work to the drawings and specifications.

22
23 END OF SECTION 15481

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1 SECTION 16000--ELECTRICAL GENERAL PROVISIONS

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 The Subcontractor shall provide, install, terminate, and test all the systems as described in
8 the specification and shown on the drawings to make complete and operational systems
9 including but not limited to:

10
11 Removing a motor circuit protector and replacing it with a circuit breaker in motor
12 control center MCC-OGF-1049 in CPP 1773.

13
14 Installing a lift pump control panel, manual transfer switch and a heavy duty power
15 receptacle.

16
17 Installing the associated conduit, junction boxes, wiring and grounding.

18
19 RELATED SECTIONS:

20
21 02200 Earthwork (duct bank installation)
22 03301 Cast-In-Place Concrete
23 15480 Stormwater Lift Stations
24 15481 **Sump** Pump and Accessories
25

26 REFERENCES:

27
28 The following documents, including others referenced therein, form part of all 16000
29 series sections to the extent designated. Unless otherwise indicated, use the latest edition
30 in effect as of the date of these specifications.

31
32 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

33
34 ANSI C-2 National Electrical Safety Code (NESC)

35
36 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

37
38 NFPA-70 National Electrical Code (NEC)

39
40 CODE OF FEDERAL REGULATIONS (CFR)

41
42 29 CFR 1910 Subpart S OSHA Electrical Safety

43
44 FACTORY MUTUAL (FM)

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CANADIAN STANDARDS ASSOCIATION (CSA)

NATIONAL RECOGNIZED TESTING LABORATORIES (NRTL)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

UNDERWRITERS' LABORATORIES, INC. (UL)

UL 486A Wire Connectors and Soldering Lugs for Use with Copper
Conductors.

Underwriters Laboratories (UL): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriters Laboratories, Inc. All material, appliances, equipment or devices shall be listed and/or labeled by UL.

SUBMITTALS:

Test Reports and Procedures: Submit test procedures and reports for a construction component test (CC) of all equipment for controls and devices installed or modified by the Subcontractor. Prior to testing all procedures shall be submitted for Contractor approval.

See Section 01300, Submittals and Vendor Data Schedule for additional submittal requirements.

PART 2--PRODUCTS

Furnish all labor, materials, equipment and appliances required to complete the installation of the complete electrical systems. The completed electrical system shall conform with applicable provisions of the specifications and the subcontract drawings. All labor, materials, service, equipment, and workmanship shall conform to the applicable referenced standards and regulations.

MANUFACTURERS:

Where multiple units of a product are required, provide identical products by the same manufacturer without variations except for sizes and similar variations as indicated.

MATERIALS:

Except as otherwise indicated, furnish new electrical products, free of defects and harmful deterioration at the time of installation. Provide each product complete with trim, accessories, finish, guards, safety devices and similar components specified or recognized as integral parts of the product, or required by governing regulations.

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Unless otherwise indicated by the drawings or specifications or approved in writing, the materials and/or equipment furnished under these specifications shall be the standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's standard design.

Environmental Conditions:

All installations and equipment shall be required to operate normally under the following climatic and geographic site conditions

Site Elevation.. ..	.4,917 feet
Barometric Pressure.. ..	.12.27 psia
Relative Humidity.. ..	90% max. at 30°F dry bulb 15% min. at 60°F dry bulb
Uniform Building Code.Seismic Zone 2B
Temperature.. ..	.+40°C max. -40°C min.

NEMA 3R enclosures will be provided for all outdoor equipment and NEMA 1 for all indoor equipment unless noted otherwise on drawings.

Labeling: See Section 16195 -Electrical Identification for labeling requirements.

PART 3--EXECUTION

SEQUENCING/SCHEDULING:

General: It is recognized that the subcontract documents are diagrammatic in showing certain physical relationships which must be established within the electrical work and in its interface with other work, including utilities and mechanical work, and that such establishment is the exclusive responsibility of the Subcontractor. Subcontractor shall arrange electrical work in a neat, well-organized manner with conduit and similar services running parallel with the primary lines of the building construction.

Subcontractor shall locate operating and control equipment properly to provide easy access, and working clearance in accordance with the NEC. Subcontractor shall advise other trades of openings or clearances required in their work for the subsequent move-in and assembly of large units of electrical equipment.

QUALITY CONTROL:

Subcontractor Supplied Testing: Upon completing installation of all systems and equipment, but prior to project close out, the Subcontractor shall conduct a construction component test (CC) of all equipment for controls and devices installed or modified by

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1 the Subcontractor. As a minimum, all of the manufacturers' recommended pre-startup
2 tests and measurements shall be performed as well as other CC tests required by these
3 specifications. Prior to testing all procedures shall be submitted for Contractor approval.
4 All equipment shall test satisfactory or be repaired or replaced at no additional cost to the
5 Contractor.

6
7 As part of the Construction Component (CC) Tests, all electrical connections and
8 mounting fasteners shall be tightened to torque specifications stated by the equipment
9 manufacturer. If manufacturer has no recommended torque value tighten as per UL
10 486A.

11
12 The Subcontractor shall test all devices in the presence of the Contractor's Representative.
13 Subcontractor shall coordinate testing with the Contractor.

14
15 Contractor Inspection: Surveillance will be performed by the Contractor's Representative
16 to verify compliance of the work to the drawings and specifications.

17
18 END OF SECTION 16000

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1 SECTION 16109--SWITCHES, RECEPTACLES AND WALL PLATES

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Subcontractor shall provide and install receptacles of sizes, ratings, materials and types as
8 shown on the drawings. Work includes installation of new devices as detailed on contract
9 drawings.

10
11 SUBMITTALS:

12
13 No Vendor Data required for this section unless an "or equal" item is submitted for
14 review.

15
16 RELATED SECTIONS:

17
18 16000 Electrical General Provisions
19 16110 Electrical Raceways
20 16120 Cable, Wire, Connectors and Miscellaneous
21 16195 Electrical Identification
22 16450 Grounding

23
24 PART 2--PRODUCTS

25
26 MATERIALS:

27
28 Weld Receptacles: Provide 480 Vac 60 Hz 3 phase, 4 wire welding receptacle assemblies
29 where shown on drawings. Receptacles shall be heavy duty, circuit breaking Crouse-
30 Hinds Model AREA10425 or approved equal.

31
32 PART 3--EXECUTION

33
34 INSTALLATION:

35
36 Install receptacles where indicated on the drawings in accordance with recognized
37 industry installation practices.

38
39 LABELING:

40
41 Label all covers and plates. Install labels per Section 16195 for Electrical Identification.

42
43
44 FIELD QUALITY CONTROL:

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- 1 Site Tests: The Subcontractor or his agents shall perform the following:
2
3 Visual inspection to determine that equipment installation conforms to NEC,
4 these specifications and the drawings.
5
6 Subsequent to hooking-up cables/wires and devices, energize circuitry and
7 demonstrate functioning in accordance with requirements.
8
9 Contractor Inspection: Surveillance will be performed by the Contractor's Representative
10 to verify compliance of the work to the drawings and specifications.
11
12 END OF SECTION 16109

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1 SECTION 16110--ELECTRICAL RACEWAYS

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Section Includes: Work includes, but is not limited to:

8
9 Subcontractor shall provide and install electrical raceways of types, grades, and sizes
10 as shown on the drawings. Provide complete assembly of raceway including, but not
11 necessarily limited to, couplings, elbows, adapters, hold-down straps, and other
12 components and accessories as needed for a complete system.

13
14 Coordinate with other work as necessary to interface installation of electrical raceways
15 and components with other work.

16
17 RELATED SECTIONS:

18
19 02200 Earthwork
20 03300 Cast-In-Place Concrete
21 15480 Stormwater Lift Stations
22 15481 Sump Pump and Accessories
23 16000 Electrical General Provisions
24 16195 Electrical Identification

25
26 REFERENCES:

27
28 The following documents, including others referenced therein, form part of this
29 specification section to the extent designated. Unless otherwise indicated, use the latest
30 edition in effect as of the date of these specifications. See the list of general references in
31 Section 16000.

32
33 SUBMITTALS:

34
35 No Vendor Data required for this section unless an "or equal" item is submitted for
36 review.

37
38 PART 2--PRODUCTS

39
40 MATERIALS:

41
42 Conduit and Fittings: Rigid Galvanized Steel (RGS) conduit or Intermediate Metal
43 Conduit (IMC) shall be used for all conductors where buried in earth, in masonry, in

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concrete, and in damp or wet locations. All conduits shall be UL approved, 3/4-in. minimum unless shown otherwise on the drawings.

Polyvinyl chloride (PVC) conduit that is encased in concrete shall be type EB (Encased Burial). All underground bends of 30 degrees or more shall be rigid galvanized steel conduit.

Electrical metallic tubing (EMT) shall be installed in all areas except those stipulated for rigid conduit or IMC. EMT shall be UL approved, standard weight, electro-galvanized steel.

Liquid-tight, flexible conduit shall be installed in wet locations. Liquid-tight flex shall be grounding-type with a PVC jacket.

Conduit fittings for rigid conduit (RGS or IMC) shall be rust-resistant cast steel.

Conduit fittings for EMT shall be steel, rain-tight compression type.

Junction Boxes: Junction boxes in the catch basin shall be watertight rust-resistant cast steel approved for installation in Class I, Group C and D atmospheres. Junction boxes in the 12 in. PVC sump pump pipe shall be weatherproof rust-resistant cast steel. Other junction boxes shall be galvanized.

Locator Ribbon: Locator ribbon shall be installed approximately 6 in. above buried conduit and ductbanks. See Section 02200 for buried pipe identification ribbon requirements.

Framing Channel for Conduit/Box Support: Where indicated on the drawings or as required by the NEC, bolted framing channel shall be used to support conduits and electrical boxes. Galvanized Steel channel shall be used in all outdoor/exterior locations and epoxy painted channel in all interior locations. The minimum size bolt used for bolt framing channel together for a support structure shall be 3/8". The exposed ends of all framing channels shall have a protective cap installed. Sizes shall be as detailed on the drawings. All framing channels shall be made of channel, fittings, and hardware as defined in MFMA-1 and shall be minimum 14-gauge steel. Framing channel shall be as manufactured B-Line Systems or approved equal.

PART 3--EXECUTION

INSTALLATION: Install conduit, tubing and duct products as indicated on the drawings in accordance with manufacturer's written instructions, applicable requirements of NEC and National Electrical Contractors Association's "Standard of Installation," and complying with recognized industry practices to ensure that products serve intended functions.

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All conduit joints shall be cut square, threaded, reamed smooth, and drawn up wrench tight. Bends or offsets shall be made with standard conduit bending dies that will not injure or flatten the pipe.

Rigid conduit terminating at cabinets and boxes shall be rigidly secured with locknuts inside and outside.

Male threads on exterior runs of galvanized steel conduits shall be thoroughly coated with a conducting sealing media such as petroleum base products. No red lead shall be used on any conduit joint.

All conduit penetrations through building walls, fire walls, or floors shall be sealed around outside of conduits with sealant appropriate for wall material (i.e., grout for concrete walls, fire stop caulk for drywall, etc.).

CONDUIT IDENTIFICATION:

Label conduits per Section 16195--Electrical Identification.

UNDERGROUND DUCTS:

All underground ducts shall be installed in locations shown on drawings, enclosed in a red concrete casing. The concrete casing shall also enclose all standard conduit bends or elbows. All underground ducts shall have rebar reinforcement in sizes as shown on the drawings.

Excavate the trenches to provide elevation on top of concrete envelope as shown on drawings. After trenches are excavated and graded, the duct shall be laid in rows on plastic spacers or approved equals.

Spacers shall be so placed that each section of duct is supported at intervals as specified in NFPA 70 (NEC). Concrete shall then be poured until the ducts are covered to the required depth and leveled leaving not less than 3 in. of concrete over top tier of ducts.

FIELD QUALITY CONTROL TESTING:

Site Tests: The Subcontractor or his agents shall perform visual inspections to determine that equipment installation conforms to the NEC, these specifications, and the drawings.

Contractor Inspection: Surveillance will be performed by the Contractor's Representative to verify compliance of the work with the drawings and specifications.

END OF SECTION 16110

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SECTION 16120--CABLE, WIRE, CONNECTORS AND MISCELLANEOUS
DEVICES

PART 1--GENERAL

SUMMARY: The Subcontractor shall furnish, install, and terminate all cables conductors, and devices to make complete and operational systems.

Section Includes: Work includes, but is not limited to wiring for:

Power and control systems.

Subcontractor shall provide, install, and terminate cables, cords, and wiring connectors of sizes, ratings, materials and types as shown on the drawings or described in related sections.

Related Sections: See other related sections for specific cables, wire, labels, and testing requirements.

16000 Electrical General Provisions
16110 Electrical Raceways
16195 Electrical Identifications

REFERENCES :

The following documents, including others referenced therein, form part of this specification section to the extent designated. Unless otherwise indicated, use the latest edition in effect as of the date of these specifications.

NATIONAL ELECTRICAL CABLE ASSOCIATION (NECA)

Standard for Installation Practices

UNDERWRITERS LABORATORIES, INC. (UL)

UL 1581 Electrical Wires, Cables, and Flexible Cords

SUBMITTALS:

Test Reports: Submit test reports for end to end continuity tests and megger tests of all 480 V wiring and all cables or wires No. 8 and larger prior to terminating.

See Section 01300, Submittals and Vendor Data Schedule for additional submittal requirements.

PART 2--PRODUCTS

WIRING MATERIALS, 600 V:

Conductors shall be stranded for all sizes of wire and cable larger than 10 AWG.

Conductors shall be copper for all sizes.

Wire insulation shall be Type THHN/THWN or XHHW for all 600 V conductors unless otherwise noted. Minimum size of power conductors shall be No. 12.

Wiring shall be color-coded as indicated below:

Conductor	Conductor Color Code		
	208/120 Volts*	480/277 Volts"	240/120 Volts*
Phase A	Black	Yellow	Black
Phase B	Red	Orange	Red
Phase C	Blue	Brown	
Neutral	White	Gray	White
Ground	Green	Green	Green

* For conductors larger than #10 AWG not generally furnished with colored insulation, identification shall be achieved by the use of plastic tape or sleeves of the appropriate color. Yellow phase tape shall consist of two separate bands at each application point in order to avoid confusion with white, gray, or orange after aging. All wire markers and phase tape shall be covered by clear heat shrink sleeving.

Wire #10 AWG and smaller shall be furnished with continuous colored insulation for all power, neutral and ground conductors when multiple circuits are installed to identify the phase connected to, neutral, or equipment ground wiring. Bare copper conductors shall only be used for ground conductors as shown on the drawings.

SPLICES:

Splices for underground (cathodic, grounding and power) cabling shall be UL listed and labeled and be of the material type and design appropriate for the conductors and application involved. Scotchcast splice kits shall be used for cathodic protection cable splices.

All splices shall be visually inspected for material type, proper installation and damage by the Contractor's Representative.

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Splices shall be installed by qualified craftsmen that routinely perform this task as part of their regularly assigned duties.

CONNECTORS:

Connectors shall only be used as specified by manufacturer.

Spring type pressure connectors such as "Scotchlock," shall be used for splicing No. 8 AWG and smaller.

Splitbolt and/or lug type connectors such as "Burndy" shall be used for splicing No. 6 AWG and larger.

Scotch mastic pads (or approved equal) and two layers of half wrapped electrical tape shall be installed over all splitbolt connectors.

Crimp on ring tongue lug connectors such as "Stakon," shall be used for connection to terminal boards.

Wire/Device Identification: See Section 16195 Electrical Identification.

WIRING MATERIALS. SIGNAL CABLES:

The ultrasonic transducer extension cable shall be RG-62/U Type Belden 82269 or approved equal.

PART 3--EXECUTION

INSTALLATION:

General: Install electrical cable, wire and connectors as indicated on the drawings, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure products serve intended functions. All connections shall be tightened to the manufacturers published torque values. Where manufacturer does not specify torque requirement, connections shall be torqued to values specified in UL 486A.

Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.

Pull conductors together where more than one is being installed in a raceway. Do not exceed the conductor manufacturer's recommended pulling tension.

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1 Use pulling compound or lubricant, where necessary; compound must not deteriorate
2 conductor or insulation.

3
4 Use pulling means including fish tape, cable, or rope which cannot damage raceway.

5
6 Install splices and taps which have mechanical strength and insulation rating
7 equivalent-or-betterthan conductor.

8
9 Use splice and tap connectors which are compatible with conductor material.

10
11 FIELD QUALITY CONTROL:

12
13 Subcontractor Supplied Testing:

14
15 Meggering: Megger test all 480 V wiring and all cables or wires No. 8 and larger prior to
16 terminating. Test wire or cable insulation resistance with megger (500 V megger for
17 300 V insulation and 1000 V megger for 600 V insulation). Any wire with less than
18 10 megohms to ground or other conductors shall be replaced before proceeding with the
19 terminating. List conductors tested on Subcontractor furnished test data submittal sheet.

20 **An** alternate megger test voltage can be used as recommended by the manufacturer for the
21 specific cable or wiring. Check phase rotation of all three-phase circuits.

22
23 The Subcontractor shall perform an end to end continuity test on each conductor installed
24 and submit test results to the Contractor for review.

25
26 Contractor Inspection: Surveillance will be performed by the Contractor's Representative
27 to verify compliance of the work to the drawings and specifications.

28
29 The Contractors representative will witness the installation of any cables installed via
30 approved "pull by" method.

31
32 Wires and cables will be checked for proper termination and termination tightness.

33
34 END OF SECTION 16120

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1 SECTION 16195--ELECTRICAL IDENTIFICATION

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Section Includes: Work includes, but is not limited to:

8
9 The Subcontractor shall provide and install labels and identification as specified herein,
10 on the drawings, and in the appendices. See electrical drawings for equipment and wiring
11 identifiers.

12
13 Install labels on all electrical and related equipment including wires, cables, J-Boxes,
14 switches, receptacles, panels, disconnects, MCC's, PCC's, and Load Centers. Label all
15 major and subfed breakers for all MCC's, PCC's, load centers, and substation.

16
17 RELATED SECTIONS:

18
19 16000 Electrical General Provisions
20 16110 Electrical Raceways
21 16120 Cable, Wires, Connectors and Miscellaneous Devices
22 16370 Manual Transfer Switches, 600V and Less

23
24 SUBMITTALS:

25
26 No Vendor Data is required for this section.

27
28 PART 2--PRODUCTS

29
30 MATERIALS:

31
32 Adhesive Marking Labels for all Raceway and Metal-Clad Cable: Pre-printed flexible,
33 self-adhesive labels with legend, identifying system type or voltage and phase.

34
35 Wire and Cable Designation Tape Markers: Self-adhering, oil and moisture resistant,
36 vinyl labels covered with clear heat shrink tubing. Letters shall be typed on in black, non-
37 smear ink. Hand lettered labels shall not be used. Engraved identification tags may also
38 be used.

39
40 Brass, Steel, or Aluminum Tans for Valves: Metal tags with stamped legend, punched for
41 fastener. Dimensions: minimum 2" x 2" x 19 gauge with 1/4 in. radius comers and
42 3/16 in. hole for fastener.

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Brass and Steel Labels: 0.31 to 0.50 in. thick with 1/4 in. radius comers, 3/16 in. holes in corners, and black engraving.

Engraved, Plastic-Laminated Labels, Tans, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16 in. minimum thick for signs up to 20 sq. in., or 8 in. in length; 1/8 in. thick for larger sizes. Engraved legend and punched for mechanical fasteners.

Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, non-fading, pre-printed cellulose acetate, butyrate signs with 20 gauge, galvanized steel backing, with colors, legend, and size appropriate to the location. Provide 1/4-in. grommets in comers for mounting.

Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 6/32 galvanized steel machine screws with nuts, flat washers, and lock washers. All signs and labels shall be glued into place using clear GE Silicone II adhesive. Duplex receptacles and light switch labels shall be glued on only. All labels larger than 1" high x 2" long shall be glued and screwed on.

Cloth, Polyethylene, Nomex, or Vinyl Taps: Installed inside 120V outlet boxes shall be white color, sized a minimum of 1" x 3", and shall have hand written or typed labeling using permanent marker.

PART 3--EXECUTION

INSTALLATION:

Install Equipment/System Circuit/Device Identification as follows:

This includes low voltage power distribution, signal, and control systems. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply equipment identification labels of engraved plastic-laminate on all electrical equipment including the central or master unit of each electrical system and each sub breaker or controller. The labels shall be glued with clear silicone adhesive or screwed on with #6/32 galvanized steel machine screws with nuts.

Apply labels for each unit of the following categories of electrical work:

- MCC Cubicles.
- Pump controllers
- Components, wires and cables
- Manual transfer switches
- Receptacles

Apply circuit/control/item designation labels of engraved plastic laminate.

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Install labels at locations indicated and at locations for best convenience of viewing without interference with operations and maintenance of equipment.

IDENTIFICATION AND LABELING OF ELECTRICAL EQUIPMENT:

Background and legend colors for electrical equipment labels shall be as specified in Table I. List is not intended to be all inclusive and Subcontractor shall be responsible to insure that all new, relocated or refed equipment is labeled meeting the requirements contained within this specification.

Table I. Electrical Equipment Label Colors

Power System Classification	Power System Designator	Background Color	Legend Color
Normal	N	black	white
Standby	S	yellow	black
Emergency	E	red	white
Direct current	DC	black	white

Electrical equipment label and lettering size shall be as specified in Table II. If equipment size constraints make the specified label size impractical, the label and lettering size will be large as possible for that particular equipment application.

Table II. Electrical Equipment Label Sizes

Power Equipment Classification	Label Height (minimum)	Lettering Height First Line	Lettering Height Subsequent Lines
Primary Distribution Equipment	2 1/2 inch	3/4 inch	3/8 inch
Secondary Power Distribution Switches	1 inch	3/8 inch	1/4 inch
Disconnect Switches	1 inch	3/8 inch	1/4 inch
Power Distribution Panels	1 inch	1 1/2 inch	1/4 inch
Power Distribution Transformers	2 inch	1 1/2 inch	1/4 inch
PCCNCC Switchgear Switchboards	2 inch	3/4 inch	3/8 inch

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Power Receptacles	3/8 inch	3/16 inch	3/16 inch
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Electrical power distribution equipment labels shall include the following as applicable:

1. The properly assigned identifier (as shown on drawings)
2. The noun name or function description.
3. The voltage and the number of phases.
4. The power source (fed from) equipment identifier, the circuit number (if applicable), and building in which power source is located if different from equipment location.
5. In addition to the above 4 items, transformers, **UPS**, substation switchgear, load center switchgear, service entrance equipment cubicles, and disconnect switch labels shall contain the destination (fed to) power equipment identifier fed by the transformer secondary or disconnect switch.

Example Panel Labels: SLP-MA-447
 LIGHTING PANEL, 408/277V, 3 PHASE
 FED FROM: PANEL PCC-MA-448A CKT 9

PCC-cw-419
 POWER PANEL, 208/120V, 3 PHASE
 FED FROM: TRANSFORMER XFR-CW-187

Example Transformer Label: XFR-CW-187
 TRANSFORMER
 FED FROM: LC-MA-0350 CKT 55
 FEEDS: PANEL PCC-CW-419

Example Disconnect Label: DSW-UTI-4500
 DISCONNECT SWITCH
 FED FROM: LP-MA-447 CKT 9
 FEEDS: BLO-UTI-4500

Labels are to be made from materials that are compatible with the application. Brass or stainless steel shall be used where shown on the drawings.

The equipment label(s) shall be located on the front of electrical equipment in as visible a location as possible.

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1 Separate labels shall be utilized for the identification of cautions or dangers required by
2 code and as designated on the drawings.

3
4 **IDENTIFICATION AND LABELING OF CIRCUITS, CABLES, AND WIRE:**

5
6 Each individual circuit breaker in a panelboard shall be clearly identified by a circuit
7 number appropriate to the individual panelboard. All circuits, breakers, or spaces that are
8 spare, blank, or utilized for power distribution shall be properly identified on the panel
9 legend provided by the Subcontractor or manufacturer. The method of identification shall
10 be as follows:

11
12 Panelboard Breakers: Single and multiple pole breakers shall be numbered as shown on
13 the drawings and schedules. A type written circuit directory shall be installed in each
14 panel and a copy furnished to the Contractor.

15
16 Switchgear Cubicles: Label individual switchgear cubicles/cells as shown on the
17 drawings and schedules.

18
19 Conductors: All conductor identification shall include the panel identifier and the circuit
20 identification number from the panel and the voltage.

21
22 Example Conductor Label: A conductor from SLP-MA-447, circuit No. 4, @ 120V
23 would be identified with the identification number SLP-MA-447ckt 4, 120V.

24
25 Conductors to 120V light switches and 120V duplex receptacles do not need to be
26 labeled if continuous wire color code is utilized. All 277/480V circuit shall be labeled.

27
28 Each conductor or cable shall also be clearly identified and labeled in all electrical pull
29 boxes or junction boxes. Engraved, laminated plastic identification tags are acceptable
30 for this purpose when attached to each conductor or to the box collar.

31
32 Control Wiring: All control wires shall be labeled with “from” and “to” identification at
33 each termination point. The “from” location will be first and be separated from the “to”
34 location by the use of a slash (i.e. TB 1-2/TB6-5).

35
36 All exposed cables (not in conduit) used for power distribution or instrumentation shall
37 be labeled with the assigned identification number no less than every 100ft for the total
38 length of the cable. Individual conductors used for overhead power distribution shall be
39 labeled at each termination point.

40
41 Below Grade Power Circuit Identification: Securely fasten identifying tags to cables,
42 feeders, and power circuits in vaults, pull boxes, and junction boxes. Tags shall have
43 engraved legend to correspond with designations in specifications and on drawings.
44 Attach tags with approximately 55-lb. test monofilament line or one-piece self-locking

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nylon cable ties. Tag cables at each entry and exit of the manhole or once in a pull box or **J-BOX**.

Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the project secondary electrical system as specified in Section 16120.

Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

CONDUIT LABELS:

Conduits shall be identified by a label attached parallel or encircling the conduit with a legend of the conductor characteristics including: highest voltage level contained within the conduit, AC or DC current, number of phases, and service type (FA for Fire Alarm, ENS for Emergency Notification, VP for Voice Paging, EVAC for Evacuation), if applicable.

Example Conduit Label: 120V, AC, 1 Ph, FA.

Conduit labels shall be color-coded as specified in Table III:

Table III: Conduit Label Colors

Power Type	Background Color	Lettering Color
Normal Power	Orange	Black
Standby Power	Yellow	Black
Emergency Power	White	Red

Labeling Size and Placement: The minimum letter height of content and identification labels of raceways and conduit shall be as specified in Table IV below. A letter size of at least one half the trade diameter is recommended for conduit. The label shall be as long as required to display the specified information.

Table IV. Conduit Label Sizes

Raceway or Conduit Size (inches)	Minimum Height of Lettering (inches)
3/4 to 1 1/4	1/2
1 1/2 to 2	3/4
2 1/2 to 6	1 1/4
8 to 10	2 %
Over 10	3 1/2

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Note: The size refers to the nominal diameter for conduit or the width of the raceway or cable tray.

Exposed raceways and conduits shall be labeled within 3 ft of the power source and adjacent to process equipment; adjacent to each side of any penetration through floors, walls, or bulkheads. Labels shall be placed at intervals not to exceed 20 ft on straight runs of conduit. Raceways and conduit shall be labeled at least once in each room through which they pass. Labels shall be located to facilitate ease of identification. Conduction ceiling space above suspended ceilings shall be labeled.

WARNING, CAUTION, AND INSTRUCTION SIGNS:

Identify Junction and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, pre-printed on orange background. Install on outside of box cover. Use pressure-sensitive plastic labels at exposed locations and similar labels or tags at concealed boxes.

Apply warning, caution, and instruction signs and stencils as follows:

Install warning, caution, and instruction signs where required by NEC, where indicated on the drawings, and where required to assure safe operations and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with instructions or explanations needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

FIELD QUALITY CONTROL:

Contractor Inspection: Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

END OF SECTION 16195

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1 SECTION 16370--MANUAL TRANSFER SWITCHES 600 V AND LESS

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Section Includes: Work includes, but is not limited to:

8
9 The Subcontractor shall provide and install manual transfer switches of types, grades, and
10 sizes as shown on the drawings. Provide complete assembly including, but not
11 necessarily limited to hubs and other components and accessories as needed for a
12 complete system.

13
14 RELATED SECTIONS:

15
16 16000 Electrical General Provisions
17 16110 Electrical Raceways
18 16195 Electrical Identification

19
20 SUBMITTALS:

21
22 No Vendor Data required for this section unless an "or equal" item is submitted for
23 review.

24
25 PART 2--PRODUCTS

26
27 MANUFACTURERS:

28
29 Acceptable Manufacturers: Square D, General Electric, and Cutler-Hammer or approved
30 equal.

31
32 MATERIALS:

33
34 Manual Transfer Switches: Manual transfer switches shall be UL listed, NEMA 3R type
35 or as shown on drawing, heavy duty, non-fused, and have current and voltage rating as
36 shown on the drawings. Switches shall be operated with external operating handle that is
37 an integral part of the box and not the cover. The operating mechanism shall be
38 quick-make, quick-break and shall not be capable of being restrained by the operating
39 handle during the opening and closing operation.

40
41 Dual interlocks shall interlock the switch box cover with the switch mechanism and shall
42 prevent opening or closing the box cover when the switch contacts are closed and the
43 switch mechanism is in the "ON" position. An interlock release shall be provided to
44 defeat the interlocking mechanism and to permit opening the box cover when the switch

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1 contacts are closed. To defeat the interlock release and permit opening the box cover
2 shall require an external hand tool.

3
4 Switch handles shall be designed for padlocking in the "OFF" position, locking the door
5 closed to inhibit access to the switch. All current-carrying metal parts of the switch shall
6 be enclosed.

7
8 PART 3--EXECUTION

9
10 INSTALLATION:

11
12 Install manual transfer switches as indicated on the drawings and in accordance with
13 manufacturer's written instructions, applicable requirements of NEC and National
14 Electrical Contractors Association's "Standard of Installation," and comply with
15 recognized industry practices to ensure that products serve intended functions.

16
17 LABELING:

18
19 See Section 16195--Electrical Identification.

20
21 FIELD QUALITY CONTROL:

22
23 Site Tests: Visual inspection to determine that equipment installation conforms to NEC,
24 these specifications and the drawings.

25
26 Contractor Inspection: Surveillance will be performed by the Contractor's Representative
27 to verify compliance of the work to the drawings and specifications.

28
29 END OF SECTION 16370

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1 SECTION 16450--GROUNDING

2
3 PART 1--GENERAL

4
5 SUMMARY:

6
7 Section Includes: Work includes, but is not limited to: Subcontractor shall provide and
8 install grounding of sizes, ratings, materials and types as shown on the drawings and as
9 recommended by the NEC and the NESC.

10
11 RELATED SECTIONS:

12
13 15480 Stormwater Lift Stations
14 16000 Electrical General Provisions
15 16110 Electrical Raceways
16 16370 Manual Transfer Switches, 600 Volts and Less

17
18 SUBMITTALS:

19
20 No Vendor Data required for this section unless an "or equal" item is submitted for review.

21
22 PART 2--PRODUCTS

23
24 MATERIALS:

25
26 Equipment grounding conductors shall be green insulated (#6 AWG and Smaller) or bare
27 copper, sized and located as shown on the drawings.

28
29 Grounding rods shall be a minimum of 5/8-in. diameter and 10 ft long copper clad steel.

30
31 Grounding connections below grade shall be made by the exothermic welding process.
32 Exothermic welds shall be Cadweld or approved equal.

33
34 PART 3--EXECUTION

35
36 INSTALLATION:

37
38 Install a complete grounding system as indicated on the drawings in accordance with
39 applicable requirements of the NEC, the NESC, and complying with recognized industry
40 practices to ensure that products serve intended functions and comply with requirements.

41
42 All exposed noncurrent-carrying metallic parts of the lift station, electrical equipment and
43 raceway systems shall be grounded.

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1 All conduit (except spares) shall contain a dedicated grounding conductor. Connect the
2 conduit grounding bushing with a base ground conductor to the ground bus/conductor in the
3 equipment where the conduit terminates.

4
5 Conduit shall not be used as the grounding conductor.

6
7 Grounding Rods: Grounding rods shall be driven as shown on the drawings. The grounding
8 rods shall be driven so that the top of the rod is 1 ft below finished grade.

9
10 Exothermic Welds: Exothermic welds shall be made in accordance with the manufacturer's
11 written recommendations.

12
13 FIELD QUALITY CONTROL:

14
15 Site Tests: The Subcontractor or his agents shall perform visual inspections to determine that
16 the grounding installation conforms to the NEC, these specifications, and the drawings.

17
18 Contractor Inspection: Surveillance will be performed by the Contractor's Representative to
19 verify compliance of the work to the drawings and specifications.

20
21 **END OF SECTION 16450**